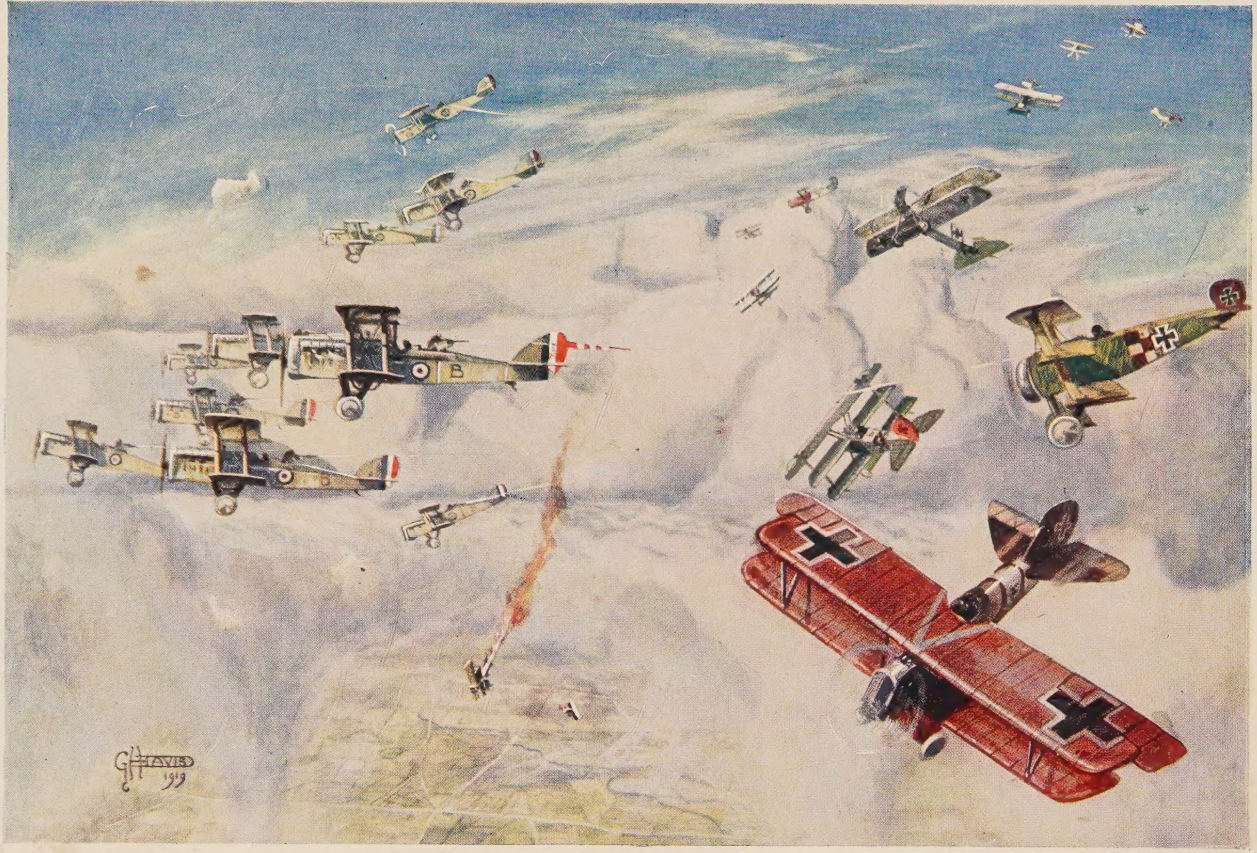
THE GREAT WAR IN THE AIR



FORMATION FLYING, 1918

The great air battles of the later stages of the war were won by skilful combination. This picture shows a British raiding squadron closing up when attacked by large numbers of the enemy. The leaders are stalling their machines slightly so as to let the laggards creep up and so present a solid mass of fire to the enemy.

(From the painting specially made for this volume by G. H. Davis.)

The Great War in the Air : By Edgar Middleton (late R.N.A.S. and R.A.F.)

VOLUME IV

THE WAVERLEY BOOK CO., LTD
96 Farringdon Street, London, E.C.4
1920

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THE GREAT WAR IN THE AIR

VOLUME IV

CHAPTER I

THE INDIVIDUAL AIR SERVICE

Some Facts and a Moral—Invincible Individuals—Since Killed—Sky Battles above the Enemy—British Airships in the War—Non-rigid Airships—The "North Sea" Airship—"Operations."

STERN moralists, imbued with the austere philosophy of the disciplinarian, or the equally narrow doctrine of the confirmed militarist—he of the "Service going to the dogs and the never mind the shells" class—may cavil at the heading to this chapter. If he deigns to read it in all probability he will throw the volume down in disgust. This is a chapter that is steeped in flesh and blood. If halting, insufficient words fail to give true expression to the great deeds which lie between the lines; or to plunge the imagination reckless on, overlooking, trampling down stops and commas; or to ignore prosaic facts in the intense warming light of individual prowess, the teller is at fault, not his story. But the spirit of the air calls for a dictionary of its own.

Rightly interpreted the moral of that story runs something on these lines. Discipline is the mainspring of military success. It makes up for lack of initiative. Individuality must be discouraged in any army, or, for that matter, in any navy. Deference to orders and superiors must be inviolable. Value of the axiom may be traced in every British defeat sustained in the past hundred years. That was the grave peril that the Royal Naval Air Service luckily avoided. The strength of the Service

lay in the initiative and personal courage of the individual. Where discipline was lacking the naval flying men gained victory after victory, due to their own daring and initiative. The Service was the individual, the individual the Service. And the end justified the means.

No brilliant victory was achieved in the air war by sea that was not a great personal triumph for one or other of the Naval Service aviators; or for which one, at least, did not pay the grim reckoning. For every man there was the deed, for every deed, the man. In Belgium,—typical instance—although he was subjected to an intense and highly accurate anti-aircraft bombardment, his machine shot about and the radiator badly pierced, Flight Sub-Lieutenant Sproatt, R.N.A.S., carried out on September 4, 1917, a bombing attack on Bruges docks, and obtained direct hits on his objectives.

In East Africa, Flight Sub-Lieutenant C. F. M. Chambers flew his machine at all hours of the day on June 10 in the naval and military operations in the neighbourhood of Lindi under heavy fire and with excellent results, bringing back to his commanding officer clear and concise reports. Instances varied little with locality. With great skill, judgment and dash, off Mudros—September 30—Flight Lieutenant H. T. Mellings single-handed attacked three, and brought down two enemy seaplanes on fire into the sea. On the same day and in the same locality, Flight Lieutenant (afterwards Sir John and K.B.E. J. W. Alcock, destined to make history as the first aviator to cross the Atlantic Ocean) also succeeded in bringing down a couple of enemy seaplanes. A few days later he was himself brought down and captured by the Turks.

Over the North Sea, the same month, is on record the instance of a naval aviator who, single-handed, swept down from the sky, and in face of the concentrated fire of all her guns, great and small, raked the decks of a German torpedo-boat destroyer with his own machine-gun fire. Both as an observer and as a pilot Flight Lieutenant L. H. Slatter greatly distinguished himself. In addition to the North Sea attack he took part in numerous night bombing raids, and on one occasion he ascended at night to attack hostile machines, notwithstanding the fact that he had only returned

a few hours previously from a successful action with hostile aircraft in superior numbers.

Sometimes over those dreary green wastes of the sea were fought some of the grimmest battles of the war in the air. With almost poetic justice, German raiders returning from dropping bombs on open, defenceless English towns and helpless women and children were themselves in turn attacked by British reconnoitring aircraft. Flight Commander G. E. Harvey on August 22 attacked a formation of 10 hostile machines returning from a raid on England, bringing one of them down into the sea. Flight Lieutenant H. S. Kerby forced another down under similar circumstances. Tragic indeed was the "since killed" which prefixed the official announcement of award of the Distinguished Service Cross to gallant Flight Lieutenant A. F. Brandon. An entire and numerous enemy squadron returning from another raid on England, Brandon attacked single-handed, and brought down one of them in flames. As his aeroplane had been hit several times he landed to change machines, and proceeded to attack again with a new one, singling out individual machines, and pursuing the enemy formation over the sea to the Belgian coast, where he made a final attack.

Sky Battles above the Enemy

Bombing the German bases along the North Sea, important railway centres, of such daring deeds the sum total was legion. To omit is harder than to recount their number. One can quote the case of Flight Sub-Lieutenant Scott. For more than an hour Scott circled at a height of only 3,000 feet over his objective—Thourout railway station and sidings—dropping his bombs singly and with excellent results, in spite of most difficult conditions. But he in turn must give way to Flight Sub-Lieutenant F. R. Johnson, who, on the night of September 20-21, swept down to well below 3,000 feet, in the teeth of a murderous bombardment, to bomb that same objective. Then Johnson's exploit again is eclipsed by that of Flight Commander R. Graham. An aviation pioneer of some note, Graham was awarded a Distinguished Service Cross, and a bar to the same "for conspicuous gallantry and devotion to duty in air fights

and bombing raids." On one occasion he voluntarily went up into the air at night to attack a squadron of German raiding machines, despite the fact that a few hours previously he had come in from a victorious action in which he had been greatly outnumbered. After the award of the bar to his D.S.C. he carried out five night bombing raids and brought down three German aircraft before he himself was brought down into the sea and drowned.

Of the bombers' own brothers in arms, the battle airmen, no less a person than the Prime Minister of Great Britain once remarked within the austere precincts of the House of Commons: "They fight the foe high up and they fight him low down; they skim like armed swallows along the front, taking men, in their flights, armed with rifle and with machine-gun. They scatter infantry on the march; they destroy convoys; they scatter dismay. Every flight is a romance; every record is an epic. They are the knighthood of this war, without fear and without reproach. They recall the old legends of chivalry, not merely by daring individuality, but by the nobility of their spirit, and amongst the multitudes of heroes let us think of the chivalry of the air."

Every flight was a romance and none more so than those many varied and bold enterprises of Flight Commander R. A. Little, of Flight Lieutenant R. A. Brown and Commander P. S. Fisher. A most efficient and plucky flight leader, Fisher also took part in numerous night bombing raids in addition to his day fighting. He fought at least six enemy pilots single-handed on one occasion, when very heavy fighting took place between eight machines of his squadron and about 20 Albatros scouts. But he distinguished himself even more when, acting as leader of a flight of five machines detailed for an offensive patrol, a general action took place with a large number of Albatros scouts, in the course of which he was wounded while fighting with great gallantry.

Flight Lieutenant Brown's finest effort occurred on September 20. He was leading his flight when they encountered five Albatros scouts. Without hesitation, he dashed on ahead and dived single-handed into the midst of them. Singling out one German machine in particular, he gave chase, opening

rapid fire. Suddenly one of his guns jammed. He carried on with the other. The enemy plane went down out of control, and over on its back, and remained in that position for about thirty seconds, while Flight Lieutenant Brown continued firing until his other gun jammed. Just at that moment, a pilot of his patrol fell out of control. Like a flash, four enemy machines dived after him. In the nick of time, though both his guns were jammed, Brown dived swiftly at the attackers, and drove them off, saving the other pilot's life.

Flight Lieutenant Little's record was one of a series rather than an individual brilliant deed. On April 28 Little destroyed an Aviatik; on April 29 he shot down a hostile scout, which crashed. On April 30, with three other British machines, he went up against enemy aircraft and saw a big fight going on between them and the British fighter escorts. He attacked one at fifty yards' range, and brought it down out of control. A few minutes later he attacked a red scout with a larger machine than the rest. This machine was handled with great skill, but by clever manœuvring he got it into a good position, and shot it down out of control.

Again on July 10, Little observed two Aviatiks flying low over the lines. He dived on the nearest one, firing a long burst at very close range. The enemy machine dived straight away, and he followed him closely down to 500 feet, the enemy machine falling out of control. On July 20, he attacked a D.F.W. After a short fight the enemy machine dived vertically. Its tail plane seemed to crumple up, and it was completely wrecked. On July 22, again he attacked a D.F.W. Aviatik, and brought it down completely out of control. On July 27, in company with another pilot, he attacked an Aviatik. After each had fired about 20 rounds, the enemy machine began to spin downwards. Flight Lieutenant Little got close to it, and observed both the occupants lying back in the cock-pits as if dead. The machine fell behind the enemy's lines, and was wrecked.

British Airships in the War

It is to be noted, but must not be concluded, that as no reference has been made yet to the work of the British airship,

lighter-than-air craft did not play an important part in the war in the air. That was not the case. The aeroplane was the eye and the brain of the Army; the airship was not only the eye and the brain, but was, for the time being, the British Navy. After the German submarines had bottled up the Grand Fleet, as securely as a specimen in an hermetically sealed jar, in Scapa Flow, the airships were ordered out to sweep the prowling U-boats from the seas. But those airship pilots proved insatiable in their efforts. They were not content to obey orders from doubting superior officers of the Navy that floats; very soon they took over the work of the parent body in its entirety. Subsequently, the airship was mainly responsible for the safe transport to Europe of the first American contingent. The Germans would be the first to admit that, despite submerged mines and Q-boats, and other ingenious devices, it was due firstly to the vigilant crews of the British airships that their campaign of U-boat frightfulness was defeated. At least that is the general impression one gathers from careful scrutiny of the official log-books of wrathful German submarine commanders.

The airship as a destructive engine was an innovation of the Great War that had very small beginnings. The outbreak of war found the Royal Navy in possession of seven airships, all of the non-rigid type, only two of which were really effective. By October 31, 1918, they had increased to 103, including rigids and non-rigids. Four of the original seven had been taken over by the Admiralty from the Army on December 31, 1913. As a matter of fact, the first British airship, "Nulli Secundus," had appeared in the air as early as 1907. She was of the semi-rigid type, with a rigid frame running fore and aft along the bottom of the envelope, and a car attached. She was deleted before the outbreak of the war. The "Beta" dated from 1910. She was a non-rigid airship and the car was rigged to a girdle of fabric stuck and sewn round the envelope. Later in the same year the "Gamma" was produced. The chief innovation in her construction was a fabric envelope, whereas the two previous ships had gold-beater's skin. She was the first Army airship to be fitted with swivelling propellers, which were the invention of Mr. Willows, one of our pioneer airship navi-

gators. The "Delta," built in 1912, was remarkable for the first use of "dope" on her envelope to prevent gas leakage. While the "Eta," built in 1913, gave her name to the "Eta patch" system of attaching rigging cables to the exterior of the envelope. This was a great improvement on the girdle system. These last four ships were in use when war broke out, and the "Beta" went to Dunkirk, but was never used.

The Navy commenced airship experiments in 1911 with a rigid airship which was accidentally broken in two before she made a flight. Nos. 2, 3, and 4 were non-rigids. Of these, No. 2 was a parent of the S.S. (Submarine Scout) type. No. 3 was an Astra Torres, trilobe in shape, with internal rigging, built in Paris. No. 3 patrolled the Channel during the crossing of the British Expeditionary Force and was subsequently employed for a while in Belgium. No. 4 was a Parseval, bought from Germany, of 360,000 cubic feet capacity. The Parseval type was rigged externally to a girdle. On the night of August 5-6, 1914, this ship patrolled the Channel from 7 p.m. until 5.30 a.m.

Non-rigid Airships

During the war four types of non-rigid airships were constructed in Great Britain: Parseval, Submarine Scout, Coastal and North Sea. The "S.S."—the Naval Service name for the Submarine Scout, more commonly known as the "Blimp"—was rigged externally to Eta patches, while the Coastal and North Sea airships used the Astra Torres system of internal rigging.

Small "S.S." ships were first constructed in 1915, and at once proved their value. An improved class known as "S.S. Zero" held the field until the advent of the "S.S. Twin" in 1917. This former type had a blunt-nosed envelope with its greatest diameter about a quarter of the length from the nose. Its cubic capacity was 70,000 feet, its length was 145 feet, and its greatest diameter 29 feet. The car carried a crew of three. The record flight for a Zero lasted for 50 hours, 55 minutes.

The Twin had, as its name implied, twin engines, two 75 h.p. Hawks. Its capacity was 100,000 cubic feet. Its length was 164.5 feet, the greatest diameter being about 32

feet. It was considered a most useful and satisfactory class, and soon supplanted the other S.S. classes.

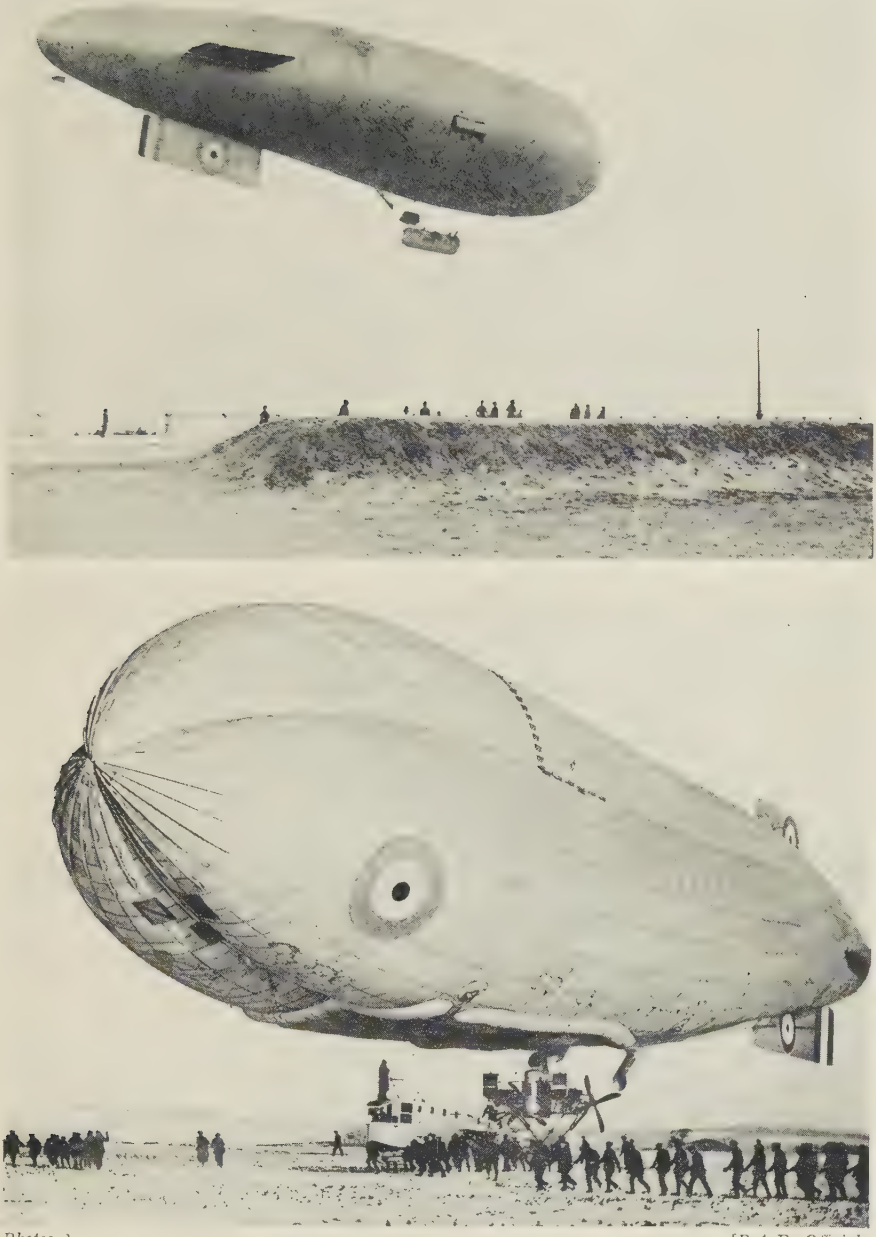
Of somewhat larger dimensions, the Coastal type had a capacity of 200,000 cubic feet, and the car would hold a crew of five. Airships of this type did most of the long-distance patrols during the last two years of the war, and were largely employed in convoying ships from beyond the Scilly Isles up the Channel. Their work proved most satisfactory, but they, in their turn, were supplanted by an improved class known as the C* (Coastal Star). It was a slightly larger type of aircraft (211 feet long and greatest diameter 42 feet), and the envelope was of a better stream-line shape to minimise air disturbance. The first C* appeared in January, 1918, and nine more were added before October 31. The C* was fitted with a 110 h.p. Berliet engine forward and a 260 h.p. Fiat aft.

The "North Sea Airship"

Perhaps the most numerous of this class of non-rigid airship, certainly the most valuable, was the "North Sea" type. By this time British non-rigid airships had proved superior to any others of the type in the world, and in the design of rigid airships Britain was rapidly advancing to the foremost place, despite the lead of twelve years which Germany gained and was able to use with such advantage in the operations of her Zeppelins as sea scouts in 1914-15-16. In its function as an aerial cruiser with the German Fleet the Zeppelin had proved a distinct success, owing to its ability to remain in the air for long periods.

Pending such time as a British rigid airship could be produced to rival the Zeppelin, a large non-rigid airship was developed for work with the Grand Fleet. This airship, which was known as the "North Sea" or "N.S." type, possessed only one-seventh of the gas capacity of the Zeppelin and less than a quarter of the power. It was nevertheless able to carry out long flights, only exceeded in duration by the record voyages of the largest Zeppelins.

It was an "N.S." airship, in fact, which on one occasion flew for 2 days and 13 hours, not as an endurance test, but in the course of ordinary escort duty.



Photos :] [*R.A.F. Official.*

TWO SUCCESSFUL BRITISH AIRSHIP TYPES

The top picture shows the famous "SS" airship or "Blimp," first introduced in March, 1915. These were originally made with aeroplane bodies and engines suspended beneath the gasbag. The bottom picture is of a "C.P." or "Coastal Patrol" airship. Both types are "non-rigid," and the latter holds the endurance record for ships of this type.

The Individual Air Service

The envelope of the N.S. had a gas capacity of 360,000 cubic feet, giving a total lift of about 11 tons. It was designed on the Astra Torres principle, which possessed the great advantage that the bulk of the rigging for suspending the car was placed inside the envelope, thus reducing the amount of exposed cordage to offer resistance to the passage of the airship through the air. The envelope was trefoil in shape as viewed from one end, composed of three longitudinal lobes, "streamlined" from bow to stern to diminish air resistance.

The car, swung close under the envelope, was large enough to accommodate the crew of 15. It was 35 feet in length and entirely enclosed. All the controls and navigating instruments were installed in the forward compartment, which was fitted with windows to give the pilot a wide field of vision ahead and below.

Next to the control compartment was the wireless cabin, equipped with instruments capable of transmitting messages over distances of many hundreds of miles.

A corridor was arranged on one side of the car. Walking aft one came to the quarters for the crew when off duty. One "bay" of the car was arranged as a mess room with light collapsible tables and seats, and the adjoining compartment was furnished with bunks for the "watch below" to rest.

The engines were placed aft of the car in a separate "power-unit," which was reached by means of a walking way slung across to bridge the gap. Two engines, each of 260 h.p., were mounted side by side, and a small cabin for the engineers was disposed centrally in the space between. These engines were readily accessible and the engineers could easily get at them to make adjustments in flight, an advantage which rendered airships much less liable to engine failure than aeroplanes.

The N.S. airship was not designed for high speed, but at full power a speed of 50 knots could be maintained. Her main duty consisted of patrolling the seas in search of roving enemy submarines. All these various aircraft were under the direct command of, and all their manœuvres when in mid-air were controlled from, the aerial headquarters with the name of "Operations."

"Operations"

"Operations," in fact, was the name given to the nerve-centre of the headquarters of groups of R.A.F. squadrons which patrolled the coastline, particularly to fight this same submarine menace. "Operations" had under its control land planes, seaplanes, flying boats and airships, and worked in conjunction with the Naval authority of the district, which in turn was controlling the floating scouts, the watchers and listeners. There was in fact a splendid and wonderfully effective collaboration between the forces of the sea and the forces of the air.

In the Dover group, in particular, "Operations" controlled some 300 miles of coastline, from a little room in an old-fashioned house. With that little room all the seaplane, airship and land plane stations of the area were connected by telephone, and in some cases by wireless. Round its walls were many maps and charts of the coast, and all the aircraft stations were marked with various coloured flags denoting the type of aircraft in use there. One map would show the number of aircraft available for flight on that particular day; another, positions of wrecks—every possible kind of useful data being marked down—coast routes, cross-Channel routes, coal routes, etc. Hourly weather reports would come in from different sections of the patrol district, so that "Operations" always knew the air condition in its area.

Most important of all, perhaps, was a large table on which the coastline was modelled. This showed also the sea area for about a hundred miles out. Here might be seen from hour to hour the exact positions of aircraft doing patrol (positions having been given by wireless), the areas under Naval patrol, the position of convoys, moving to and fro from the ocean, the progress of vessels outside the ordered coastwise routes, and the position of mines. And upon this table was marked the last known position of enemy submarines, the track of their movement being plainly shown, the point of their successful and unsuccessful attacks being noted. Everything was timed.

Altogether "Operations" was the key to a wonderful system, and one which proved its efficiency over and over again in locating the enemy submarine. As has been remarked, the air-

ship enabled many thousands of American troops to be brought safely across the perilous waters. The anti-submarine branch was a service that required great patience, unending watchfulness, keenness and endurance. The pilots and observers, it is true, ran no risk of "Archies" and "flaming onions" (though there were cases of submarines firing on airships and seaplanes), but they had their special perils and their special compensations.

They were the avenging hunters, matching their wits against those of the U-boat commanders and compassing the destruction of hundreds of those sinister craft.

The executive side of all this work was impressively wonderful; but even more wonderful still was the working of the brains behind it all, the ceaseless working of "Operations" in those wonderful little nerve centres of the war by air that were dotted all around Britain. Information of the most varied kind came buzzing in electrically all through the day and night, week after week, month after month; and those brain cells of the R.A.F. observed it all, collated, classified, tabulated, distributed and utilised it in a hundred different ways.

CHAPTER II

RIGID AIRSHIPS AND OTHERS

Brigadier-General Maitland—10,000 feet Drop by Parachute—On the Belgian Coast—Maitland's Development of the British Airship—A Patriotic Move—The R33 Class of Airship—R9—R23—R34—Unusual Complications in Construction—An Aerial Dockyard—Earlier Stages of Construction—When the Ship was Complete—Airship Incidents—Mid-sea Air Attacks—More about Rigid Airships—A Night Aboard a British Rigid—Over the North Sea—Submarine!—Airship Losses in 1917.

THE astonishing and rapid development of the British airship was in no small measure due to the faith and indomitable courage of one man—Brigadier-General (Air Commodore) E. M. Maitland, C.M.G., D.S.O., A.F.C.—formerly a captain in the Essex Regiment, and one of the early pioneers of ballooning, aviation, and airship navigation. To him, more than to any other, is due the credit of the recognition of the tremendous value of the lighter-than-air type of craft in the development of modern warfare, and the building up of a war-worthy fleet of British airships of the larger rigid type. When the war broke out Britain was over twelve years behind Germany in this matter of the construction of rigids, or "Zeppelins." As is generally known, Germany, after many experiments and failures, staked her all on airships of the Zeppelin type, of which she had a considerable fleet in 1914, the first direct use of them being made in the bombardment of Antwerp in the early days of the war.

It is equally noteworthy that Count Zeppelin, the pioneer of the dirigible airship, met with the same opposition before he could prevail upon the German military authorities to listen to his arguments in their favour. He had, indeed, actually to sacrifice the whole of his private fortune in the construction of his experimental ships, all of which suffered disaster upon disaster.

Rigid Airships and Others

By the time of the signing of the Armistice, General Maitland's airship fleet had become the most powerful and efficient in the world; ten British rigid airships were actually in co-operation with the Navy at sea. The General encountered every possible opposition from those in authority, and but for his dogged perseverance and his whole-hearted, self-sacrificing efforts in this vital matter, Britain would have been in a most perilous position.

He was the first to experiment in the descent by parachute from an airship. One chilly autumn morning in 1916 he dropped 10,000 feet from a balloon over London.

As he waited in the car of the balloon to make the drop, Flight Commander John Dunville, his companion, eagerly advised him to abandon the attempt. Maitland's only reply was sudden as it was characteristic of the man. He clambered over the side of the balloon without a word. "It was most unpleasant," was his disappointing statement made afterwards to an ardent inquirer.

General Maitland's first and only passion was aviation. Balloon, airship, aeroplane, it was immaterial to him which it was, for he was a qualified pilot of all three craft. But the lighter-than-air craft commanded his first attention.

A nasty spill in an aeroplane immediately prior to the war somewhat shook his faith in aviation. He more than regained it, however, when, after a long and desperate struggle, balloons, kite-balloons, and airships innumerable were entrusted to his charge.

On the Belgian Coast

Along the Belgian front, in those early days of the great conflict, men said that danger attracted Maitland like a magnet.

He certainly appeared to risk his neck, not once, but many times a day, peering out over the German lines from a swaying captive balloon, all the time under heavy fire of the enemy guns. The statement indicates the nature of the man, and Colonel Maitland, as he then was, had a definite object in view. The invaluable data collected during these hazardous enterprises was to be employed in arousing the stolid imaginations of that

same British Admiralty to the necessity of lighter-than-air craft.

He gained his point, and, to signalise his victory, the first man ever to attempt such a feat, he made a long flight in a captive balloon deliberately cut away from its moorings at Roehampton Naval Air Station. Thereafter he became impressed with the value of the parachute as a safeguard for aviators. Innumerable were the drops that he made—he would allow no one of his junior officers to risk his neck in this manner until he himself had proved it safe—from altitudes of one to ten thousand feet.

Maitland's Development of the British Airship

For the most part, however, the General's attentions were confined to the very necessary development of lighter-than-air craft, and under active service conditions it may truly be said that the British airship developed beyond expectations. The capacity of the non-rigids, if one excepts the Barton ship of 1903, which made only one flight, increased from 12,500 to 360,000 cubic feet in ten years. With a capacity of 1,500,000 cubic feet, R31, the latest British rigid airship at the time of the signing of the Armistice, was roughly double the size of the Vickers "naval" airship of 1911; and with the advent of the R34 (capacity, 2,000,000 cubic feet), this increase in size was almost trebled by the time of the signing of the Peace Treaty. This rapid and unusual development may be traced with greater ease in the following tables:—

Name		*Capacity c.f.*	*Length ft.*	*Engines*
S.S. Zero (N.R.)	1916	70,000	145	———
Rigid 9 (R9) .	1917	800,000	529	Wolseley-Maybach.
Rigid 23 (R23) .	1917	900,000	535	Rolls-Royce.
Rigid 27 (R27) .	1917	1,000,000	540	Rolls-Royce.
S.S. Twin (N.R.)	1917	100,000	164	(2) 75 h.p. Hawks.
Parseval 6 (N.R.)	1917	360,000	312	Maybach.
Parseval 7 (N.R.)	1918	360,000	312	Maybach.
Rigid 24 (R24) .	1918	900,000	535	Rolls-Royce.
Rigid 25 (R25) .	1918	900,000	535	Rolls-Royce.
Rigid 26 (R26) .	1918	900,000	535	Rolls-Royce.

Rigid Airships and Others

Name		*Capacity c.f.*	*Length ft.*	*Engines*
Coastal * (C *) .	1918		211	—110 h.p. Berliet.
(N.R.) .				—260 h.p. Fiat.
Rigid 31 (R31) .	1918	1,500,000		———
Rigid 32 (R32) .	1919	1,550,000	615	Rolls-Royce.
Rigid 33 (R33) .	1919	2,000,000	670	(5) Sunbeams.
Rigid 34 (R34) .	1919	2,000,000	670	(5) Sunbeams.

(R.) Rigid airship; (N.R.) non-rigid; (S.R.) semi-rigid; (c.f.) cubic feet.

It will be remarked that no mention so far has been made in this history of the work of the British rigid airships in the war. Owing to the necessary official secrecy maintained, the flight of the R26 over London on Lord Mayor's Day of 1918 was the first intimation to the general public of the existence of a British "Zeppelin," as it was popularly termed. It may prove somewhat of a surprise to the reader, then, to learn that no fewer than ten British rigid airships in the last few months of the war were co-operating with the Navy in deep-sea submarine patrols and reconnaissance flights with the Grand Fleet. There were three distinct types of these ships: the R9 1916 type, the R23 type of 1917, and the R33 type of 1918.

After the misfortune to the first naval airship no rigid was produced in Great Britain until December, 1916, so that this country was for the first two years of the war twelve years behind Germany in the construction of rigid airships. As early as December, 1913, however, the final designs of the R9 had been submitted by Messrs. Vickers to the Admiralty. For five years the Lords Commissioners hesitated to proceed with this new airship. It was not until after the outbreak of war that orders for delivery were finally issued. In March, 1915, work on the R9 again was suspended by Admiralty orders, in favour of more urgent demand for aeroplane construction. And it was not until after the Battle of Jutland Bank, when impressed by the invaluable assistance rendered the enemy fleet by Zeppelins during the battle, that the naval active service command began to urge upon

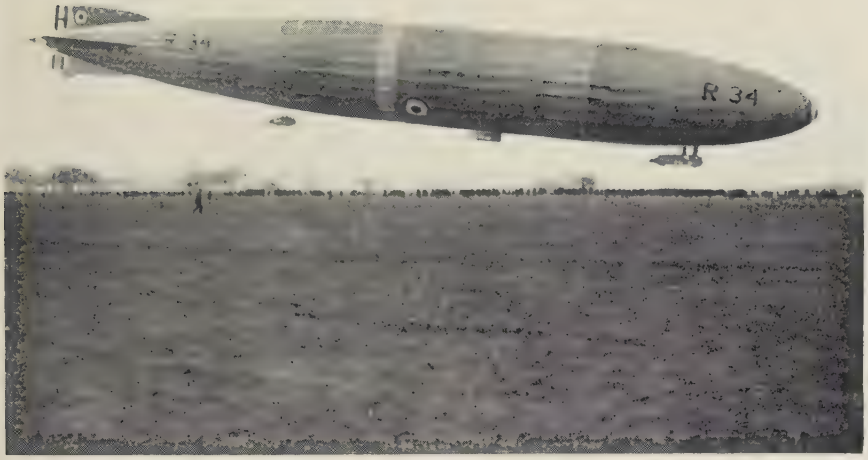
the authorities the necessity for British rigid airships, and permission at last was granted Messrs. Vickers to resume work on the R9, and three further large airships were commissioned.

A Patriotic Move

The airship firms at this period offered one of the finest examples of true patriotism of the war. Though rival concerns, and all of them about to embark upon a new industry, Messrs. Beardmore, Armstrong, Whitworth, Short's, and Vickers, from whom were commissioned respectively the R34, the R33, and the R37, the construction of which was afterwards abandoned by the orders of the Government, came together in conference, and placed all the experience and knowledge derived from costly and difficult initial experiments at the common disposal.

In March, 1917, meanwhile, very successful flight trials had been carried out over Morecambe Bay by the R9. Throughout her long and valuable service this ship was employed in every experimental stage of British airship development. Intended primarily for training the crews of the later ships, afterwards she carried out long anti-submarine patrols over the North Sea, and in the closing stages of the war was employed to carry out experiments in connection with the system of mooring airships out on land and sea. The R26, after many valuable reconnaissance flights for the Grand Fleet, took part in the surrender of the German submarines at Harwich, November, 1918, and also made a record flight of forty-one hours. Every ship from the R9 to the R27 was of purely British design; but the R33 class was adapted from the specifications of the German Zeppelin, L33, which was brought down in an almost complete state near Colchester in September, 1916.

The cubic capacity of the L33, and alike of the R33, was roughly 2,000,000 cubic feet. The Zeppelin, 680 feet in length, was ten feet longer than the British class of ship, with a fifteen-foot greater diameter. For the rest, the L33 carried six engines of 240 h.p. each, which were housed in four gondolas, one in the front, one in each of the side gondolas, and three in the rear gondola. The aluminium framework of the ship



Photos :] *[Illustrations Bureau.*

BRITAIN'S GIANT AIRSHIP

The top photograph shows the great airship "R 34" coming to earth after a flight. Beneath is a photograph of an aeroplane attached to the keel of R 34, with the pilot on board, ready to be loosed at a moment's notice in mid-air for purposes of attack or defence.

was of the lattice girder type, triangular in section. Enclosed in this framework were nineteen ballonnets made of finely woven cotton fabric, and "doped" to make them gastight. These ballonnets were secured to the girder framework by a cord netting of fifteen-inch mesh, which surrounded them. Working on these specifications, Messrs. Beardmore, Armstrong, Whitworth, Short, and Vickers produced four British rigid airships, which were in commission by January 1st, 1918. The principal dimensions of the rigid type were as follows:—

R9.

Gross gas capacity	800,000 cubic feet.
Overall length	520 feet.
Overall width	53 feet.
Overall height	76 feet.
Gross total lift (@ 681 lbs. per 1,000 cubic feet)	24 tons.
Disposable lift (available for fuel, oil, stores, crew)	5.2 tons.
Total maximum power of engines ...	600 b.h.p.
Make of engines	Wolseley-Maybach.
Speed at full power	45 m.p.h.
Cruising speed (at one-third power)	32 m.p.h.
Crew carried	14 men.
Endurance at full power	18 hours = 800 miles.
Endurance at cruising power ...	50 hours = 1,600 miles.

R23.

Gross gas capacity	900,000 cubic feet.
Overall length	535 feet.
Overall width	53 feet.
Overall height	75 feet.
Gross total lift (@ 681 lbs. per 1,000 cubic feet)	27 tons.
Disposable lift	6.3 tons.
Total maximum power of engines ...	1,000 b.h.p.
Make of engines	Rolls-Royce.
Speed at full power	55 m.p.h.
Cruising speed (at one-third power)	38 m.p.h.

Crew carried	16 men.
Endurance at full power	18 hours = 1,000 miles.
Endurance at cruising power ...	50 hours = 1,900 miles.

This class of rigid airship was constructed of frames of duralumin girders. The whole framework was enveloped in a fabric cover, inside of which were gas bags, which were thus protected from the action of sun and moisture. Other British ships of this class were the R24, R25, R26, R27, and the R31.

R34.

Gross gas capacity	2,000,000 cubic feet.
Overall length	670 feet.
Maximum diameter	78 feet.
Disposable lift	29 tons.
Make of engines	Sunbeam.
Speed at full power	60 m.p.h.
Cruising speed	46 m.p.h.
Crew carried	30 men.

Along the inside of the bottom of the hull of this ship runs a keel forming a kind of tunnel through the chambers, which gives access from one car to another, and contains the petrol, oil and water tanks. A portion of this space is screened off as a dining- and recreation-room for the crew.

Four cars are attached to the underside of the hull of the R34. The leading car contains the navigating compartment from which all the controls of the ship are worked. Containing the wireless cabin, this car is connected with the other cars by telephone, telegraph and voice pipe. Detached but adjoining the fore gondola is an engine-room containing a single motor which drives one of the propellers. Amidships are two small gondolas side by side, each housing an engine and each driving a propeller. While in the sternmost gondola two more engines are fixed, which drive yet another propeller. In all there are five Sunbeam engines of the Maori type, of 275 h.p., driving four propellers. The sister ship of the R34 is the R33.

The cost of constructing an airship of the R34 type is approximately £350,000. Fourteen officers and 400 men are required at the station for handling, berthing and cleaning

airships. The estimated total monthly cost of the airship when in commission depends on the distance flown. Taking as a basis 8,000 nautical miles per month at a speed of 40 knots, it amounts to about £2,600 at current rates for cost of petrol, oil and gas. This figure includes the wages of the crew and also one-fourth of the total pay of the personnel required for handling, etc., as this latter is adequate for maintaining four ships in commission.

Some idea of the multiplicity of parts and manufacturing operations involved in the construction of a rigid airship of the latest type may be gained from the following items:

Total number of drawings required is over 600.
Approximate number of different parts = 21,000
Approximate number of individual parts of the airship = 1,600,000.
Total length of angle and channel sections in duralumin = 20 miles.
Total length of wire in hull = 53 miles.
Total area of fabric = 30,000 square yards.
Total number of rivets put in = 1,250,000.

An Aerial Dockyard

During the war the matter of the construction of aeroplanes usually fell within the province of the Air Ministry, who were responsible from the moment of the first two pieces of framework being put together until that when the machine intact was handed over for trial to the capable hands of the Royal Air Force test pilot. But not so with airships. The lighter-than-air was the aristocrat among aircraft. Almost every engineering firm in this country, after a few months' experience, could—did invariably—turn out dozens of aeroplanes a month. Airship construction, on the other hand, was an exclusive—it could be said, badly understaffed—industry. Airship maintenance, direction and control, for that matter, throughout the war was centred under a special and distinct command.

The airship command in itself was unique. It was broker between the manufacturer of the raw materials and the finished craft cruising the skies under expert pilotage. It was the

Harrods Stores to one customer—the British Government, supplying men, material and craft. Unlike the aeroplane branch, all departments were housed under one roof, under one command. And the greatest problem of all which airship command handled was that of demand and supply of airships and their necessary pilots.

The airship envelope "nurseries" in themselves were a revelation. One, typical of all, was situated in the grounds of the old White City exhibition, in the London area. To inspect it was like, for all the world, paying a visit to an indoor dockyard. There was over a mile of hangar space, great lofty galleries varying in size from a concert room to that of the popular exhibition hall, proportioned to berth every class of ship from the Baby to the N.S. Every one resembled a large dry dock, save that where the latter sloped upward and outward in tiers from the base the order was reversed in the case of the aerial dock. Gaunt scaffolding, rising gallery after gallery, with a small staging immediately beneath the roof, traced the outline of the envelope, as to be always in reach of the workmen and the dope hands. In one corner was a small generator room and a large air-pumping apparatus for inflating the envelope. The construction was of an intensive nature. The smallest slip in the early stages of construction necessitated complete renewal, if not a scrapping of the entire material. As the officer in charge said: "No feat of engineering construction is more delicate or intricate than that of the airship envelope."

Earlier Stages of Construction

The work commenced with the raw material that was delivered at the station in bales, much as could be seen in the usual draper's shop, to the small army of women employed on the cutting, stitching, machining, and doping of the material into panels, and eventually into the finished envelope. The exacting condition of this work may be judged from the fact that in a single gore—a seam that extends from the nose to the tail of the ship—it was necessary not only to double-stitch the material, but also to cover it within and without; then, to safeguard any possible escape of gas through the thread holes,

the entire outer skin was doped. That dope was a special preparation applied by a special system of sprays—both British secrets. But only the envelope was constructed here, though, to be sure, repairs on "dead" ships were also effected. These melancholy invalids lay around the floor in masses of sagging material awaiting patches and repairs. Then the finished envelope was sent out to the car manufacturers, to be fitted for service in the air.

When the Ship was Complete

The art of the airship pilot was actually a combination of the two branches of the science—and it is a science—of flying, aerostatics and aerodynamics. Even the craft itself in its early and smaller stages was half balloon, half aeroplane, with the body of the latter for a car. In the actual flying of it, the "blimp" rose from the ground and landed balloon-wise, but in the air the movements of control were almost identical with those of a plane. For its essential job of submarine sinking the airship was the ideal craft.

From a certain altitude the bed of the sea to a depth of several fathoms was thrown into bold relief. That altitude was the working level of the airship. And though the airman was aware of the submarine's locality, the commander of the latter, immersed under the sea, was blind to the danger overhead. And rapidly as the submarine was able to submerge and dive through the water, the airship was even swifter in its descent through the air. As aeroplanes had become an essential to the Army, so had airships to the Fleet. The range of operation from aircraft bases was extensive. Those bases were not necessarily ashore, but sometimes aboard ship—the deep-sea patrol.

In weather-stained, sea-coloured log books of airship commanders stories of pilots battling with sudden storms eclipsing those of Jules Verne were to be found. There were miraculous escapes from drowning when the ship, through some mechanical failure or escape of gas, was borne down rapidly towards the surface of the sea. And there were memories of desperate engagements with German aviators far out across the sea and out of sight of land; several instances

of escape from burning vessels as by a miracle; and one at least of a ship which went out from an east coast base one summer's morning and was never seen again. Only some charred wreckage was swept up by the sea some days later, which was identified as part of the missing craft. The German daily *communiqué* supplied the missing details: "Four of our seaplanes yesterday attacked a British airship over the North Sea, with great success. Last seen she was plunging down towards the water a mass of flames." Imagine the sensation experienced by those poor fellows hopelessly cooped up in a confined space no larger than that of an armchair, helplessly drifting with the wind that fanned the flames into a roaring furnace, and with only the prospect of a horrible death by burning or an adventurous drop hundreds of feet down into the sea. Such an escape was accomplished on two or three occasions most successfully. In one instance the crew got clear away, and their craft, partly submerged in the water, was saved by a torpedo-boat.

Mid-Air Sea Attacks

Another, again a "blimp" on a long reconnaissance, ran into a fog. For nearly an hour it flew blindly, and was just turning for home when suddenly the mist lifted, revealing only a mile away a U-boat with its conning-tower and deck well out of water. Opening his engine full out, the pilot steered directly for the boat; the occupants of which were evidently wide awake, for they immediately brought their quick-firing gun into action. In spite of the bursting shells, the airmen pushed on without changing their course, and soon were within effective machine-gun range. The observer used his Lewis to such good effect that with one drum he accounted for the submarine's gun crew. In view of this and without bothering to rescue their own wounded, the Germans began hurriedly to submerge. Meanwhile the wireless operator of the "blimp" was busy sending out urgent signals to the various British patrol boats and submarine-chasers which were known to be in the vicinity. Then, climbing to a height of about 1,500 feet, the pilot got ready to use his heavy bombs, one of which was fastened on each side of the nacelle.

Although submerged the U-boat was still easily visible, and taking careful aim through his sights the "blimp" gunner pulled the trigger of the releasing gear. Relieved of the heavy weight, the "blimp" shot upwards like an elevator. Careless of its movements, its occupants hung over watching the bomb sink swiftly, until it struck the water perhaps 200 feet ahead of the target. When a fuse came into action, a flash of lightning seemed to rip through the dark depths of the sea, and a peculiar brown, cloudy mass enveloped the fore part of the U-boat. It seemed ages before the effect of the explosion reached the surface, and then, like a geyser, the water shot up into the air. In the centre of the disturbance the gaping hull of the U-boat momentarily appeared on the surface of the water.

More about Rigid Airships

So much, then, for the smaller type of ship, the one remaining is the "rigid"—the British Zeppelin.

Over 600 feet long, following almost exactly the lines of the original Zeppelins, these monsters had three cars attached to the keel of a cigar-shaped envelope, and operated mostly at night. Almost any fine evening one might see them looming over the shadows of the east coast: silent visitors, that crept up from the inshore country, signalled to those mysterious unseen watchers of the coast, and disappeared, as mysteriously, out to sea. The rigid was essentially a bird of the night, though its duties also included convoy work and submarine chasing.

A Night Aboard a British Rigid

At night, then, let us go out with a British rigid, bound on her routine reconnaissance patrol over the North Sea. Let us, too, make one of those phantom-like excursions, enjoyed by so few, envied by so many. As the twilight begins to fall over the countryside, the huge doors of the iron shed are slowly swung open and the form of the giant airship exposed to view. At first glance she appears to resemble the Zeppelin type, and indeed she is almost a copy of the German airships which, until they were beaten off, used to appear with such frequency over England.

One by one the crew climb up the companionway and disappear in the forward car, distributing themselves in their correct stations in the body of the vessel. The captain remains below until the whole body of the ship has emerged into the open. Then, when she floats steadily a few feet from the ground, held down by men who grasp the ropes which hang from the framework, he also climbs in, gives orders for the release of the necessary ballast and the hauling in of the ropes, and then, as the rigid rises steadily in the evening air, moves a lever in the forward cabin. A moment later the forward engine starts up with a roar, and gradually the huge bulk gains way, moving slowly over the ground.

As the speed increases, a turn of the wheel moves the elevators, the nose of the airship rises, and the outlines of fields and hedges grow dim as the coastline approaches.

Over the North Sea

To leave the car where he has been standing so far, the captain has to climb through a narrow door, and then by means of a frail aluminium ladder passes close by the revolving propeller, over part of the body of the ship, and through another gap into a narrow keel. A false step at this point in his movements would mean instant death, either from the huge propeller or from the fall to the sea, many hundreds of feet below.

However, once inside the keel, matters are easier. Here a gangway leads from one part of the airship to another, a frail pathway, less than a foot in width, hanging from the framework above and enclosed merely by thin fabric.

One after another he visits the stations in the vessel: navigating car, wireless cabin, engine room, gun platform. All are found correct. At each place well-trained men are attending to their duties and keenly on the look out for all that passes on the sea below.

Once during his rounds a light flares out from a drifter. A quick telephone message to another part of the ship, and an answering signal appears far forward. But for the signal the drifter would probably have opened fire, for the British airship is not distinguishable from a Zeppelin at night.

All being well, the captain gives his second in command the necessary instructions, and settles himself on the floor of the cabin amidships. It is quiet here, for the noise from the forward engine, which itself is enough to keep cruising speed on the vessel, is barely heard in this place.

Then the captain is aroused to take over again. The greyness of the early morning is already overcoming the darkness. Glancing round him, he notices the huddled forms of some of the crew, resting, but ready at a moment's notice to spring to their stations. One man, whose head reposes on a huge bomb, which stands ready for use the instant a submarine is sighted, smiles in his sleep. It is a grim smile, and by the movements of his hands he appears to be firing his Lewis-gun in dreamland.

A breeze has arisen during the last few hours, ruffling the surface of the sea and causing the ship to roll a little. The captain glances out of the port in the side of the car. Away to the left the coast shows dimly in the greyness. A few small boats move upon the sea—drifters and mine-sweepers, coastal motor-boats and destroyers—all intent upon their work.

Submarine!

As he looks down, he sees suddenly a narrow, dark shadow appear on the water, growing every moment more distinct. It breaks water ahead and to one side of him. He shouts an order to the helmsman, and as the vessel swings round, sets the bells ringing in the engine-room and cabins. Every man springs to his post. Drums of ammunition are placed on the guns, and bombs are held in readiness for release. Then, as the submarine comes directly below the airship, the captain sees that the craft far below is British, and swings off, disappointed. He has lost the chance of an absolute "sitter." His particular airship already has several U-boats to her credit, but she is several points behind some others of her class.

Glancing at the clock, he sees that they have been over seven hours in the air, and as broad daylight has appeared and home is far away, he decides to return. Round swings the huge vessel in a wide circle and sets her nose for the aerodrome.

When at length land is reached, the sun is shining and the fields are full of workers, who glance up in surprise at the mammoth of the air as she flies over them—at a speed of over sixty miles an hour.

The long sheds at last come into sight, and some distance from them a squad of men waiting patiently for the arrival of the airship. A wireless message has been sent out warning the station of the great vessel's home-coming, and all is prepared for her reception. A short distance from the sheds the engines are stopped, the gas valves opened, and the airship begins to sink. The huge propellers are swung to the horizontal, and the mooring ropes soon come within reach of the waiting men below. Then the landing party slowly tow the monster into the shelter of the sheds, where she is made fast.

Not till then does the crew leave the ship and walk towards the mess for a well-earned breakfast.

"What luck?" asks the landing officer.

The captain of the ship frowns darkly. It seems to him that the U-boats are growing very scarce.

Meanwhile, in this chapter, we must pass on to a brief résumé of the functions of these many types of airships during the war. These functions were two in number, namely, to combat the submarine menace and to act as scouts for the Fleet. Bomb-dropping raids over the land were not attempted by British airships and were only considered of minor importance by the Germans.

Rigid airships were the best of scouts for a fleet at sea. The Germans owed their escape after the battle of Jutland to their Zeppelins. It was the Zeppelins which made possible the escape of the flotilla which raided Scarborough on Easter Monday, 1916; and it was Zeppelins which enabled the U-boats to torpedo H.M.S. Nottingham and Falmouth, as well as the Cressy and the Hogue.

The struggle with the submarine menace entailed two sorts of work, patrol and convoy. While on patrol the airships, particularly the S.S. type, were able to compass the destruction of numerous submarines, either by using their own bombs or by summoning surface craft. They were also able to direct

"TRENCH STRAFING"

Actual combat with the infantry of the enemy was developed by the "contact patrol" planes to a degree that became a terror to the Germans. This picture shows a trench being cleared, with bombs and machine-gun bullets, by the British planes.

(*From a painting by Joseph Simpson.*)

vessels out of a danger zone. Mines were likewise observed and destroyed.

The system of convoy by airship proved extremely successful. No ship was ever sunk while under escort from the air. This work was very arduous and required constant vigilance.

Airships were not so independent of weather as were heavier-than-air craft, but it is interesting to note that in 1918 up to the time of the signing of the Armistice there were only nine days on which no flying took place.

It was a popular belief that airships required an extravagant number of mechanics. When the number of flying hours is set against the number of hands employed, airships are shown to be more economical in man-power than heavier-than-air craft, as the following figures show:

	Airships	Aeroplanes and Seaplanes
Men employed per hour flown ...	1.62	3.52
Hours flown per man employed ...	1.04	.40
Average duration of patrol	6 hrs., 17 mins.	2 hrs., 2 mins.

The following table shows the hours flown from 1915 to October 31, 1918:

1915	339	hours.
1916	7,078	,,
1917	22,389	,,
1918	53,554	,,

The total casualties to airship personnel during the war were 239, of which 48 were fatalities due to flying accidents and enemy action. For every fatality suffered 42,548 miles were flown. In the airship service credit was claimed, not for losses suffered, but for losses inflicted on the enemy, and for averting losses from one's own side. When the potential destructiveness of each U-boat is considered, the service of the airships in securing the food supply of Great Britain and escorting troopships cannot easily be over-rated.

Airship Losses in 1917

Finally, it must be stated that in the 22,389 hours of airship flight of 1917 only three British airships were lost. On April 23 German aviators brought down off Nieuport a "North Sea"

type of airship, which fell into the sea in flames. No trace of the crew nor any portion of this craft was ever found. A second airship of similar type was forced to descend in Holland through engine failure on December 12. This ship —No. 26—according to unofficial information, fell on to some houses at Utrecht at 6.30 a.m. on December 13. Again, on December 15, another British airship of the non-rigid type, with a crew of five aboard, was brought down by a German seaplane in the southern part of the North Sea.

CHAPTER III

SEAPLANES OVER THE NORTH SEA

Seaplane Sorties—Sea Training, Ship Recognition—A Month's Work—An Encounter over the North Sea—Stroke and Counter-stroke—Incidents by the Way—A Double-handed Aerial Sortie—Air Fighting over the Sea—An Epic of the Sea Air War—One Against Ten—Difficulties of Seaplane Patrols—Aeroplanes at Sea—Submarine Hunting by Airship—Detection by Oil Patches—Rigid Airships to Guard the Fleet—Aerial Adventures at Sea—A Miraculous Escape—A Gallant Failure—British Naval Bombers at Work—The Bombing of Bruges.

It is no far cry, as the understanding might imagine, from airship to seaplane. Where one was the eye—that ever-watchful roaming eye, missing not the most minute detail, to which the whole sea surface, and several fathoms beneath the surface, was as an open book—the other, undoubtedly, was the blow behind the glance. Like a perfect body corporate, the relation between sight and action was delicately attuned almost to a minute fraction. Slower, perhaps steadier in its flight, certainly more accurate in its observations, the airship, far ahead and well out of sight of land, would sight and immediately flash the position of a roaming enemy under-seas craft to the seaplane bases ashore, where the faster, more heavily armed craft were always ready waiting at a moment's notice to dash out and answer that insistent call—the matadors of the sea-air ring.

As with their conscious gaiety and unconscious invincibility of spirits, the naval aviators always took their various jobs with the seriousness each and every occasion warranted, without knowing that they did so, anti-submarine patrols soon attained the standard of a fine art. In this game it was ship recognition which mattered.

In the case of seaplane and airship crews alike it was

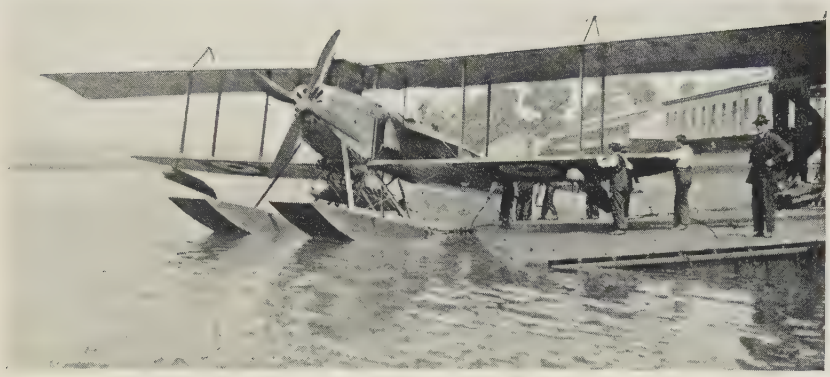
essential that they should be able to recognise immediately any particular type of ship they might sight, whether friend or enemy, and it was to train their senses in this direction that "ship recognition" was made an important item in the curriculum of the preliminary training flying schools.

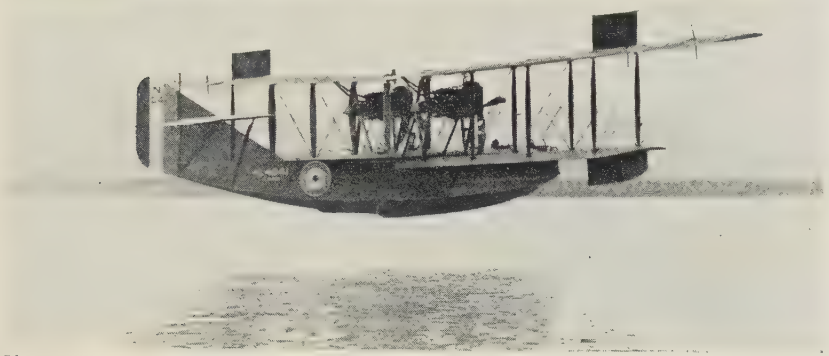
First of all, the students were given large silhouette drawings of all the important classes of modern war vessels: British, French, German, etc. Each such drawing had to be copied accurately to scale, time after time if necessary, until the peculiarities of rigging and construction of all types were memorised. A brief description of the speed and armament in the case of foreign vessels had also to be learned and remembered.

The students then climbed into the basket of a balloon, so slung as to reproduce approximately actual ballooning conditions. Twenty or thirty yards away was a table, the surface of which was painted to represent the sea; and here the instructor stood with a whole collection of wonderfully lifelike models of the ships that had been studied. One at a time he placed these models on the table, leaving them for the fraction of a second, during which time the pupils in the basket had to identify them. The whole thing was done exactly to scale, so that the space between the models and the basket really represented a distance of, say, five miles.

Having passed out on the table tests, the students now carried on their work at a lake which was a few yards farther away. The lake in question was actually a large ornamental duck pond, but when across its placid surface were dragged all manner of extraordinary lifelike miniature battleships, cruisers, destroyers, submarines, liners, standard ships, all made exactly to scale, it was easy to imagine that it was a section of the North Sea. Looked at through field-glasses and from a distance, it gave one the impression of being quite the real thing.

It was an efficient and most useful period of training which almost prepares the reader in advance for the long list of achievements of the naval aviators at sea—entirely apart from their shore bombing and reconnaissance patrols and squadrons. To choose an instance: In one month—September, 1917—and





Photos :] [*Short Bros.*

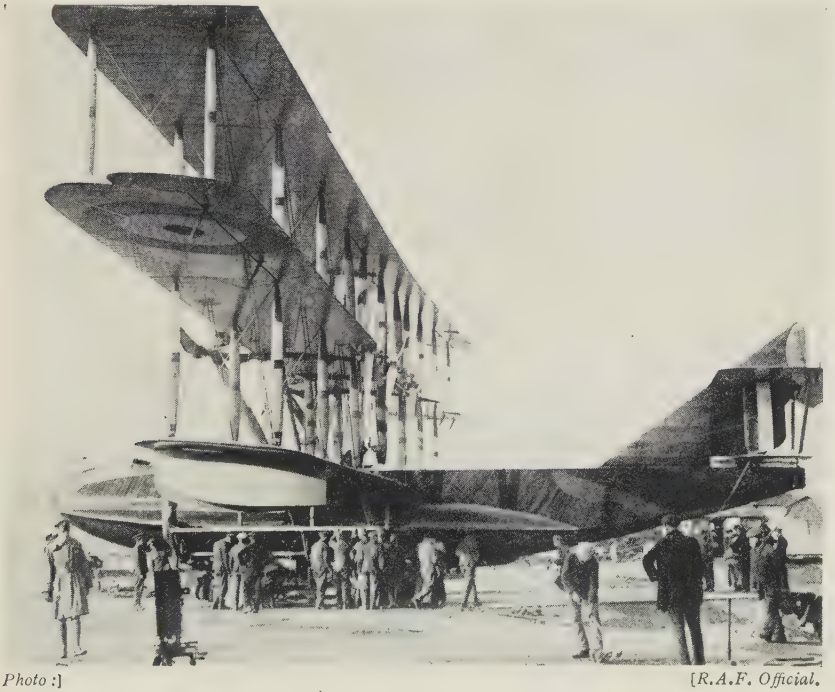


Photo :] [*R.A.F. Official.*

THE CRAFT OF THE NAVY THAT FLEW

The top photograph shows a Short torpedo-carrying seaplane, with torpedo in position between the floats. The middle photograph is of a Short "F" flying-boat with twin engines, whilst the bottom photograph is of the gigantic Porte Super-Baby flying-boat—a triplane.

as highly authenticated official reports go to show, the total distance covered by seaplane and airship patrols was over 170,000 miles, of which 90,000 miles was covered by seaplanes and 80,000 miles by airships.

On seven occasions ships, which were being attacked by submarines, sent S O S signals, which brought seaplanes to their assistance in time to save them by compelling the submarines to dive. Several hundreds of ships were convoyed during that month by aircraft, and in no single instance had a submarine dared attack a ship while under aircraft escort. The number of submarines attacked and destroyed by British aircraft was great, and that method of attack can be described in a few words.

When a destroyer sighted a submarine some five or six miles away, he went full speed to the attack at about thirty miles an hour, so that the submarine had ten minutes or so in which to dive beyond the reach of the destroyer's depth charges. But when a seaplane sighted a submarine at the same distance he flew to the attack at anything from 80 to 100 miles an hour, so that the submarine had only three or four minutes before bombs began to fall all round her. It is not suggested, however, that destroyers had been superseded by the seaplanes as the enemy of submarines. On the contrary, the two very often worked together, and their co-operation usually spelt disaster for the U-boat.

An Encounter over the North Sea

In September, 1917, a British seaplane sighted a German submarine on the surface, flew directly over her before she had a chance to dive, and dropped a bomb on her tail which was seen to make a large hole in the deck. Immediately afterwards the seaplane pilot saw through the mist three more German submarines in line abreast, followed by three German destroyers and escorted by two German seaplanes. All six vessels fired their anti-aircraft guns at our seaplane, but the German seaplanes did not attack, because they could not get through the barrage put up by the fire of their own destroyers and submarines. Our seaplane turned, dropped another bomb on the wounded submarine, saw her sink amidst a pool of oil, in which

fragments of her floated, and then retired from an unequal contest, at the same time sending a wireless message as to where three of the enemy's destroyers were to be found.

The mere presence of the seaplane many times saved a merchant ship when a submarine was attacking it. Moreover, when the tragedy had actually occurred and the torpedo had found its mark it was the seaplane which was the first to see the shipwrecked crews in their boats, to send wireless messages for assistance, and to direct the rescuers to the right spot. It was the seaplanes and other aircraft which first sighted the deadly mine, and so helped the mine-sweepers in their task. In a word, it was the naval aircraft which were saving the lives not only of those who traversed the seas, but of every man, woman and child in the British Isles, who would otherwise have been threatened with starvation. Without a constant stream of these new aircraft to replace the inevitable wastage in machines, the struggle against the German submarines would have been prolonged even further, food would have become scarcer, and last, but not least, the lives of British sailors would have been needlessly lost.

Stroke and Counter-Stroke

The German U-boat campaign by this time had been recognised by the enemy himself to have failed in its objective. Exasperated at our successes in the air, the enemy had started to send some of his best machines across the North Sea in a vain attempt to drive away the British patrols that were constantly harrying his submarines and disclosing their position to surface craft. Again and again by giving timely warning the seaplanes had, as it were, snatched the victim from the very grasp of the enemy, and by accurate bombing had either destroyed the submarine or compelled him to dive to safety. In aero-submarine fights no quarter was given—least of all in those mortal combats in the North Sea. As typical of the fury which characterised these encounters, take this one instance, full of grim determination.

A long dark object below the sea surface was sighted by two British aeroplanes, and bombs were dropped. They fell with extraordinary accuracy. Immediately afterwards a quantity of

oil and air bubbles rose to the surface, forming two patches about ten yards wide. Scattered patches of yellow scum were also observed in the area. The aeroplanes returned to their base to report and then re-bomb, and then back again to where they had made the attack. Two large oil patches were observed and a square white object and a piece of spar were seen floating between the oil patches.

But there are these submarine stories by the score. The pilot of a seaplane noticed the track of a torpedo fired at a British merchantman. It was a miss. Altering his course he followed the track to its source. The submarine came to the surface, with conning-tower awash, and was apparently quite unaware of the presence of aircraft until the latter turned into the wind. The seaplane and the submarine were approaching one another. A bomb was dropped, and three seconds after the explosion there was a second upheaval, and for a considerable time oil continued to rise to the surface.

Incidents by the Way

The public—and, after all, who are more human?—faced with a dearth of varied incident in these seaplane-submarine encounters at the time overlooked them, certainly forgot them. They wanted the sensational. From a military point of view sensationalism was frequently without value. From every point of view the anti-submarine campaign was one of the most vital phases of the war. What if every aircraft attack upon submarines was alike down to the smallest detail? What if the methods of attack were almost identically the same on the part of every gallant British naval aviator? What if every such attack ended invariably with that oily, greasy patch rising to the surface of the troubled waters? No such attack was the less remarkable for that, no whit less valuable. For it was just one more nail driven home firm and secure into the coffin of German sea supremacy. We must judge these incidents as they ranked in war value, not for the sensation they offered.

At a distance of about two miles, one autumn day of 1917, an enemy submarine was sighted by a British airman on the surface, apparently stopped, and with a cloud of smoke or steam rising from her stern. The airman attacked. Two bombs

were dropped. The first exploded 30 feet astern of the submarine as he was hurriedly diving, and the second in the centre of a large patch of bubbles caused by the submerging vessel. Ten seconds after the bursting of the second bomb a very violent explosion was heard which was quite different from the explosion of the bombs. Immediately after this bubbles and foam appeared on the surface. Such was the force of the underwater explosion that the seaplane was violently shaken and her wireless apparatus put out of adjustment.

A few days later—November 12—two British seaplanes on submarine patrol above the North Sea sighted a submarine on the surface travelling at about fourteen knots. Two men were observed on the conning tower. Like a pair of hunting kestrels, the seaplanes swooped down to a height of 800 feet, and the leading machine dropped a bomb, which burst on the starboard side of the submarine halfway between the stern and conning-tower. The submarine heeled slowly over to port and remained in that position. The bow rose into the air as she stopped and began to sink. The second aeroplane then dropped her bomb, which burst in front of the conning-tower, and as the submarine sank another bomb was dropped by the first machine, which had wheeled round and passed over the spot fifteen seconds later. Having disposed of their quarry, the two then circled round for a quarter of an hour searching for possible survivors. None were seen, however, and they accordingly returned to make their report.

For that matter, this was far from being the only occasion on which the unwilling German aviators were drawn out from their lairs to wage the constant war by air over the North Sea. Enraged by the non-success of the campaign and the too continual loss of submarines at the hands of the British airmen, aircraft escorts now invariably accompanied their roving underseas craft. The sea air war waxed fast and furious.

In this respect the enemy was none too keen on taking the offensive unless he was in numerical superiority. He believed in the safety of numbers. Three British planes one day returning from patrol were attacked by seven hostile aircraft, five of them monoplane two-seaters and two biplane single-seater scouts.

A lively fight ensued, resulting in two of the enemy, one a monoplane and one a single-seater, being driven down out of control. All three of our machines were damaged, but they were able to get back. In one case this was only possible owing to the splendid courage of a mechanic who, with total disregard of his own personal safety, climbed out on to the plane whilst the machine was in full flight and, despite the heavy fire which the enemy concentrated on him, stopped up with his hand a leak of oil from the crank case, and so enabled the pilot to carry on flying and make a landing, some miles ahead, alongside a fishing smack.

One of our planes on another occasion attacked simultaneously by five hostile monoplanes, was hit in the gravity tank and forced to descend to the water. The officer in command ordered his crew out on the wings and the enemy attacked again, this time in line ahead from the rear, each of the five machines as it passed overhead directing a hail of bullets into the already stricken aeroplane, which immediately burst into flames. Two pilots and the machine-gunner plunged into the water, and as the machine-gunner could not swim and his belt would not inflate he was supported by the two officers for thirty-five minutes, when they were picked up by a destroyer.

An Epic of the Sea Air War

A further such encounter over the waters of the North Sea furnished an epic of air fighting history. A patrol of four British seaplanes on October 20th was attacked by seven of the enemy—one of them a large two-seater, the other six very fast small single-seaters. The enemy, cleverly camouflaged, attacked from the direction of the sun, so that they had advantage in position and numbers. The two-seater enemy concentrated his attention on one of our machines and so crippled it that it was compelled to descend and alight on the water. Whether the enemy was himself damaged or no it is impossible to say; probably he was, but he, too, glided down and alighted quite near to our machine. Then, at close quarters, the two airmen started a machine-gun duel to the death. The fight was short and furious. Both machines burst into flame and, after blazing for about three minutes, sank.

One Against Ten

Yet another such encounter was reported by the Admiralty in an official December *communiqué* as follows:

"The report of a squadron commander of the R.N.A.S. after a recent hostile air raid shows the odds which British pilots cheerfully accept in beating off the raiders. The officer in question had been flying continuously under war conditions in France, bombing and fighting, for upwards of eighteen months.

"'When at 11,000 feet,' runs his report, 'I saw ten Gothas coming inland. I climbed up to them, and engaged one on the right of the formation about three miles out to sea at something over 12,000 feet. Fired 100 rounds from straight behind his tail at 100 yards range. Bullets were seen to enter the Gotha's fuselage. Machine started into a slow spin. I followed and fired about 25 more into him to make sure. My gun then jammed, and in trying to clear I got into a very fast spin with my engines on. Got out of this just in time to see the enemy crash into the sea. I then landed, had my gun jam cleared, and went up after the remaining eight Gothas—one had been shot down in flames—and caught up with them at 14,000 feet, and engaged them in turn from above and below. Then devoted all my attention to one Gotha, and after firing 200 rounds into him silenced both his guns. I think both German gunners must have been hit, as I was able to get within 60 feet of him without being fired at. I finally ran out of ammunition.' The story ends with his ammunition."

Difficulties of Seaplane Patrols

In the beginning the chief difficulty which arose was the lack of reliable engines. Practically all submarine patrolling was done by float seaplanes with engines so unreliable that the pilot set out with the comforting knowledge, based on accurate statistics, that certain types then in use showed an average of one engine failure every hour and forty minutes. Yet the normal period of his patrol was at least two hours.

A gale might be blowing and all small craft scurrying to harbour. But he set his teeth and flew straight away on his allotted course. The coast became a blur and then faded from

sight. He knew what a forced landing among the leaping, white-crested waves below meant. Broken wings, turning over, clinging to half-submerged floats with the chances of rescue not one in a hundred.

At that time the value of seaplanes was so little recognised that often senior naval officers, under whom they worked, looked upon them as a nuisance for which ships had to be diverted from their proper work to rescue crews or salve machines. And those same crews were regarded by many people as holders of soft home jobs.

Then the airships came into use to supplement the seaplane fleet and brought with them their own special batch of troubles. Their casualties were not great, but the nerve-strain of service in them was tremendous. An off-shore wind might blow them far out to sea. The wind might increase so that the ship would be wrecked on its return. On one occasion a weather warning was delayed in transit and every airship from a certain patrol station was wrecked on returning—Polegate, in Sussex.

Aeroplanes at Sea

Still later aeroplanes were employed for sea patrol and convoy duties. Having no means of keeping afloat, these machines suffered more than even the early seaplanes, if forced to come down at sea. But they did their work—often thirty or forty miles from shore—trusting to the men at the home station who had tuned up the machines and the engines.

Thus was built up what was to develop into the most wonderful aerial convoy and patrol service in the world. Little by little the difficulties were overcome. Engines were improved, and such great strides made in the direction of seaworthiness that one of the latest seaplanes, after being disabled, drifted practically the whole distance across the North Sea, for three days riding out a gale which drove small surface craft to shelter.

In 1916 it was considered remarkable that aircraft should do 30,000 miles patrolling in a week, but now that figure was frequently exceeded in a single day. And seldom a submarine had the hardihood to attack a convoy escorted by airships or

seaplanes. On the few occasions when this occurred the U-boat was the sufferer.

Tracking the U-Boat Track

A submarine was like a whale. It had to come to the surface. There if it could be located and the airman had the patience to wait, the quarry was bound to appear.

When a U-boat was located in a certain area the aircraft searched that area continuously until it rose. They might then have a chance of bombing it or only be able to report its position to the waiting surface craft. Once touch was established, the work might be left to the latter. But if the surface craft lost touch with the prey, it was the airman's job to regain it.

The difficulty of thus maintaining touch may be judged by the fact that often only a thin streak of oil from a leaky tank might mark the course of the submarine. Then a nice calculation had to be made. The oil did not appear directly above the U-boat. The strength of the tide, the depth of the water, the speed of the submarine—all of these had to be gauged accurately if the prey was not to escape. The efficiency of British sea-going airmen had become so great that as many as thirty submarines had been attacked from the air around the British coast in one month. And besides this, a considerable further number had been sighted and compelled to submerge and their position given to surface-hunting craft.

But figures of U-boats sighted and attacked convey little idea of the value of aircraft in countering the activities of submarines. Many a time an aircraft returned from patrol with a tired and disappointed crew who reported that they had sighted nothing of importance.

They did not know that they had been sighted from the periscope of a submarine which had submerged promptly, thus having been prevented from destroying whatever ship it was stalking. They did not know, and the ship did not know, that it was only the presence of the aircraft that permitted the ship to go her way unmolested.

And so the work continued. For many months North Sea and Channel traffic was convoyed by Royal Naval Air Service aircraft. Seaplanes and aeroplanes flying two hundred miles

from their base, airships, kite balloons—all played their part with the same degree of credit as the fighter over the battle lines.

Submarine Hunting by Airship

The success of the small non-rigid airship, generally known as the "blimp," in submarine-seeking may best be gauged from the pre-armistice lament of the commander of a motor-launch flotilla. This gallant and enthusiastic officer complained that none of his patrol vessels ever saw traces of an enemy submarine, much less attacked one as the airships had driven them all away from his area. His interest in life seemed to be quite damped by what he regarded as interference with his personal bombing and shooting rights in those waters.

Cruising slowly over a suspected area of sea, the airship could observe the faintest trace of oil or the slightest disturbance of the water which might indicate the presence of a hostile submarine, though it might be so insignificant as to pass unnoticed by seaplane or surface patrols.

It was unfortunate for the U-boat that one of the failings to which it was liable was the tendency to exude a small quantity of oil, either by leakage from the fuel storage tanks or to a less extent by loss from the bearings of the hydroplanes or periscope. Also, after diving, a small quantity of unburnt oil remained adhering to the exhaust pipe of the engines. This oil rose to the surface of the sea and showed as a light patch or as a more or less continuous trail of small patches, known as an "oil slick." If the submarine was damaged and her plates strained, the amount of oil which rose was naturally greater, and could be observed with greater facility.

Detection by Oil Patches

It was in the detection of submarines by these oil patches that airships performed some of their most valuable service. The work was by no means easy, however, because seen from above there were often numerous oil discolorations on the water caused by the passage of surface vessels, and the greatest skill combined with long experience was necessary to determine which were worthy of investigation and which were not.

It frequently happened that on discovering an oil slick of

this kind an airship followed the course of the oil, proceeding at a speed perhaps no greater than four knots, keeping touch yard by yard with the indefinitely marked line, sometimes losing it and regaining touch at another spot after diligent search, much as a good hound will follow a weak scent.

Every available hunting craft in the vicinity was immediately signalled for to the spot, and bombs and depth charges were dropped around the mark. If a tideway was running, the oil had drifted some distance in rising to the surface and an allowance in aiming had accordingly to be made.

The end of the submarine was demonstrated beyond doubt by a large effusion of air bubbles and oil, the latter rising in great quantities and spreading over a large area of the sea. With subtle cunning U-boat commanders sometimes endeavoured to deceive the attackers by discharging oil to produce the idea that they had been destroyed.

On one such occasion the airship alone was not satisfied that the submarine had been effectively accounted for. Sitting motionless above the stains of oil and bombs, she was rewarded as dusk fell by seeing a white ripple break on the water in the dim light, followed by the appearance of a grey shape. Racing to attack with her last remaining bomb, she consigned the U-boat to the bottom of the sea beyond all doubt, and then flew home with the pleasant feeling of a good deed done.

Rigid Airships to Guard the Fleet

It was not only on anti-submarine patrols, however, that the airships showed up to advantage. One might go as far as to say that the best guarantee of the safety of the Grand Fleet at sea was the rigid airship.

Lord Jellicoe in his book has shown how vital a part aircraft take in modern naval warfare. An airship may in certain circumstances take the place of two cruisers. It is generally reported that no less than eleven Zeppelins took part in the Battle of Jutland, and it was probably due to their excellent services that the German Fleet escaped annihilation. On many occasions, also, when German naval forces essayed to leave harbour, Zeppelins proved of incalculable value by enabling the German ships to evade the British patrols.

When operating with the Grand Fleet airships would take up station twenty miles or more ahead of the cruiser screen, the distance ahead depending upon the strength of the relative winds. Others would be posted as wing ships to protect either flank, whilst others might be detailed for special duties away from the main forces.

On sighting hostile forces it would be the airships' duty to ascertain the enemy's strength and formation, and to estimate the course and speed of the hostile ships. Obviously this class of work demanded considerable air endurance, and aeroplanes capable of a non-stop flight of six hours or so would be of little use in protracted manœuvres. A cruise of 100 hours was well within the capabilities of large "rigids."

Contact with the enemy being made, however, the "ship-aeroplanes" carried by the Fleet could be relied upon to furnish the tactical air observation required during the engagement, whilst the airships would cruise farther afield to give warning at the approach of enemy detachments.

Aerial Adventures at Sea

These airship pilots met with many strange adventures in their varied quests, but hardly so intriguing as those which at this time befell the men of the seaplane patrols. From the constant heroism of the "little Admiral"—an Australian farmer who had come all the way from Queensland at the first call for volunteers to join the R.N.A.S. and who before the end of the war accounted for over fifty German machines and was third of the official British "aces"—Flight Commander R. S. Dallas, D.S.C.; and Flight Lieutenant Davis' heroic attempt to extricate a companion from beneath the débris of a wrecked seaplane in mid-sea, to that almost miraculous escape from death of Flight Commander E. A. de Ville, whose seaplane collided with a wireless mast in mid-air, they provide some of the most glowing records of the war.

In recognition of his services on April 23, Flight Commander Dallas was awarded a well-merited bar to his Distinguished Service Cross. With two other British machines Dallas engaged a formation of nine hostile scouts and two-seater machines. Two two-seater machines were shot down,

one of them by Dallas unassisted, and in a period from May 3 to 23rd, Flight Lieutenant G. G. Simpson drove down a hostile aeroplane out of control; with five other machines on an offensive patrol attacked six Germans—one of which he brought down out of control, a few days later attacked another at close range and brought it down in flames; finally he led a formation of five machines to attack at least twice the number of hostile aeroplanes. Both British and enemy formations split up, and a general fight ensued. Five times during the combat Flight Lieutenant Simpson drove off hostile aeroplanes from another of our machines, and one of those which he attacked was seen to go down in a spin.

An Aerial Rescue

It was on September 14 that Flight Commander de Ville's seaplane came into collision with one of the masts of a shore wireless station and remained wedged in it, the commander being rendered unconscious and thrown out of his seat on to one of the wings. Three sailors, who were in the vicinity at the time—Nicholas Rath, Seaman, R.N.R., Richard Knoulton, Seaman, R.N., and George Faucett Abbott, Deckhand, R.N.R. —immediately rushed across to the wireless mast.

Without hesitation Rath, making use of the boatswain's chair, which moved on the inside of the mast, was hoisted up by his companions to the point where the seaplane, its nose firmly wedged into the lattice work, was perilously suspended three hundred feet above the ground. Rath climbed out on the plane and held the pilot in his arms for some twenty minutes until, with great difficulty, Knoulton and Abbott climbed up alongside and passed the masthead gantline out to him. Then having secured the commander with the gantline, Rath, with the assistance of Knoulton and Abbott, lifted him from the plane to the inside of the mast and lowered him to the ground. The three men were well aware of the damaged and insecure condition of the mast, which was bent at an angle where the seaplane had become wedged. One of the three supports of the mast was fractured, and, so far as they knew, the mast—or the seaplane—at any time might have collapsed.

Seaplanes over the North Sea

A Gallant Failure

In courage and daring this incident was only equalled by Flight Lieutenant Edward Davis' fruitless attempt to save Sub-Lieutenant Grant after his machine had fallen into the sea. On October 3, 1917, whilst carrying out a practice flight, a seaplane, piloted by Sub-Lieutenant Grant, fell into the sea. The seaplane turned over and the pilot was enclosed in the boat under water. Lieutenant Davis immediately flew a seaplane to the position of the accident, made fast to, and dived under, the wreck, in his uniform and endeavoured to extricate Grant.

To do this it was necessary for him to dive amongst, and struggle through, the mass of wires and broken parts of the wreck. Notwithstanding the imminent danger of being caught up amongst them, Davis continued his efforts to get Grant out until the emergency boat arrived on the scene. No other help was at hand until the arrival of a motor-boat, which at the time of the accident was about a mile and a half away.

British Naval Bombers at Work

There were adventures of the bombing aviators of the R.N.A.S. that would compare favourably with even these rousing incidents. But they are so numerous that they would require a volume to do them justice. In fact, bombing adventures had become so frequent as to be commonplace. One may quote one thrilling mission that was now an everyday routine patrol—the bombing of Bruges.

Bruges, the most important German naval base in Belgium, had been attacked so often by British airmen that it was by this time perhaps the best defended place against night-bombing on the western front.

The pilot and observer of a British night-bombing machine proceeding to Bruges had usually no difficulty in finding their way, as a haze of light from the searchlights could be seen twenty or thirty miles off. As they drew nearer they could see a maze of fifteen or sixteen searchlights moving restlessly over the town, looking for some machine whose engine had been heard. Suddenly they saw the red flash of a bursting

bomb, and then another and another. At once chains of brilliant, emerald-coloured balls of fire poured upwards in ceaseless lines filling the sky with green bubbles of light. The machine was not picked up, however, and gradually the lights and shell-fire died away.

Ten Thousand Feet over Nothing

As they drew nearer, the observer crawled through a little door into the nose of the machine, examined his bomb-handle, and adjusted the bomb-dropping sight. As he knelt, a heavily muffled figure, in his little wooden cock-pit, ten thousand feet over nothing, he was so absorbed in watching the ground that his surroundings seemed to him perfectly normal; he was entirely at his ease.

Below he could see the black line of the canal which he was using as a guide. He turned the pilot to the left with a wave of his hand, and then again to the right, and stopped him with an uplifted arm.

Ahead he could see the dark mass of the town, and to the left the long *bassins* of the docks. Far to the left lay the dark line of the Belgian coast, and over Ostend and Zeebrugge moved the sentinel searchlights. Bruges lay dark and dim, snatching a brief rest from its tumultuous night.

The observer waved his hand, and the roar of the engines died away into silence as the machine dived towards its target. He unstrapped his bomb handle and leant far over the front, looking down to the shining water of the dock, absorbed in following the course of the little metal bar of the sight. It touched the docks and crossed them. With a quick gesture he guided the pilot to the left, and the bar swept round and crossed the section of the quay he wished to attack.

When the Bombs Fall

He checked the pilot and held his bomb-lever in readiness. Hundreds of Germans stood waiting at their guns, machine-guns, searchlights, and green ball machines. The organised hate of a community lay below the observer, but he thought of nothing save the passage of the metal bar across the black mass between the two shining strips of water.

Suddenly his "sight" registered the range. He pushed the lever forward, pulled it back again, and again pushed it forward, and again and again. From behind there came the click and clatter of fourteen dropping bombs.

He shouted to the pilot to turn, and one huge wing climbed towards the stars as the machine swept round and away from the welter of shells and searchlights that the explosion of the bombs brought whizzing about him.

Gazing downward, the observer saw at the edge of the quay a red spurt of flame which slowly died away. Two others followed, in the water where lay the destroyers and submarines, and then more and more burst on the sheds in the middle. A white sheet of flame burst from one shed, and fading slowly left a red glare—an ammunition store had been blown up. The other bombs burst across the wharves and crowded *bassins,* leaving huge clouds of white smoke where they had wrought destruction.

Simultaneously with the bursting of the first bomb, hundreds of green balls came streaming in swaying curves from the ground, and poured upwards past the wings on both sides. Like a handful of ribbons the searchlights had been thrown up, and filled the sky with wands of light which weaved a strange pattern all around the machine. Gun-fire flashed round the town, and close to the machine now burst the clamorous barrage.

It was an awe-inspiring din, but through it the observer had heard the thud of the bursting bombs below. He scrambled back to the pilot and laughed. Searchlights swept to and fro over them, under them, and on either side; ceaselessly the fantastic strings of green balls bubbled upwards, and the flash of the shells seemed to fill the whole sky.

The machine roared on homewards through a maëlstrom of flame and fire. The attack had been pressed home, and in the docks of Bruges the ammunition sheds were shattered and in flames, and water was pouring into the battered sides of the submarines. The airmen flew home, well content with their consciousness of duty well done, and left far behind the searchlights still vainly scouring every quarter of the heavens—too late!

CHAPTER IV

THE WHEELS GO ROUND

Beginnings—New Records of the Air—Activities of a Record Day—Causes and Effect—Intricacies of Aeroplane Construction—The Strain of Flying—Penultimate Construction—Two Phases of Construction—The Work of the Women—The Machine Shops—The Dope Shops.

It is a curiosity of modern war—and for that matter, of warfare of all time—that invariably some cog of the military machine, overlooked at the onset, develops finally into a decisive factor. Aviation perhaps provides the best example. Of British army commanders, but three in August, 1914, favoured the inclusion of the original tiny R.F.C. squadron in the British Expeditionary Force. Said the scoffers and cynics: But they will never fly the Channel; to take part in the war is ludicrous.

Those sixty-odd antediluvian aircraft crossed the Channel without mishap. Within six months the tiny air service had trebled in strength and activity. From heaven alone knows where, new aviators appeared on the scene by hundreds. In the second year of the war it was almost impossible to turn a square mile in this country without encountering one of the innumerable aircraft factories which, almost by the wave of a magic wand, had appeared as it were in a night. By 1917 British aircraft squadrons were at work on all fronts, from France to India, and the North Sea to the Suez Canal. In the special order of the day issued on November 25 of that year by the best informed of all the experts—Field Marshal Sir Douglas Haig—in connection with the capture of "the important Bourlon positions," it was stated: "Aircraft have co-operated with the efficiency and complete devotion to duty in which they never fail."

The Wheels go Round

New Records of the Air

Seven hundred and four aeroplanes and seaplanes were brought or driven down on the Western front, including the Belgian sector, during September, 1917, a higher total by nearly 300 than was reached in the preceding month, and compared with 467 in July, 713 in May, and 717 in April of this year. In this one month, according to the claims of German Main Headquarters, the Allies lost 242 machines, and the German aeroplanes and seaplanes which fell to British and French airmen and gunners numbered 462.

On September 25 British airmen set up a record in the number of enemy machines accounted for in one day, when 24 German aeroplanes were brought or driven down with the loss of only one British machine. Also our naval squadrons were unusually active in raiding German bases in Belgium and off that coast. Only one of the British naval machines failed to return, and, as a set-off, they destroyed or drove down seriously damaged nearly twenty German aeroplanes and seaplanes. To this must be added the fact that several leading German airmen were killed on the British front. These included Lieutenant Voss and Lieutenant Wolff, both of whom were credited with over forty aerial victories.

Continuing the interesting equation another step, in a week, from August 14 to 21, British airmen helped their guns to range on well over 700 German batteries. Aircraft and artillery co-operated so successfully that 128 gunpits were totally destroyed, and among the batteries 321 separate explosions were caused.

"As to the rest of this unparalleled week," wrote Mr. Beach Thomas, who was present at the Western Front at the time, "let the bare figures speak for themselves. They flew in the week over 1,200 hours; they took another 5,000 photographs of the enemy's territory; they dropped over 2,000 bombs, amounting to about 36 tons in weight; they fired more than 30,000 rounds from low levels at the enemy's infantry and gunners; they brought down 68 enemy planes, and are known for a certainty to have driven down 90 more, of which a greater number were certainly destroyed.

"It must be remembered that our authorities are as strict

as an adverse judge in sifting the evidence of crashed machines. Many not recorded even as hit are crashed, as later evidence has often proved. The German airmen, rather like the German gunners, have been braver at night than by day. They have bombed many places, from hospital to harvest fields."

In a single day—September 10—despite the clouds and thick haze which prevailed, making air work very difficult, observation was carried out by the airmen for the artillery, both by aeroplane and balloon. During the day British machines bombed two enemy aerodromes near Cambrai and the rest billets near Douai, and during the night of the 10th-11th inst. dropped bombs on an aerodrome and searchlights near Cambrai. In air fighting three German aeroplanes were brought down.

Bombs were dropped on Audenarde railway junction, and seven bombs on Audigny-au-Bac ammunition dump and station of Cambrai, and 61 on various other targets.

During the night hours, it should have been mentioned, bombs were dropped from an average height of 1,000 feet as follows: four on a large aerial training school near Valenciennes, twelve on Ramegnies Chin aerodrome, near Tournai; twelve on Somain railway junction sidings (two of which fell directly on the sidings); seventeen on Mouveaux and Lezennes aerodrome, near Lille; six on sidings between Douai and Somain; and two on Ledeghem railway station, south of Roulers.

It adds but necessary interest to the point at issue to repeat that this was the result of a single day's activity on the part of the British airmen. How many aircraft does the reader imagine were necessary to carry through this comprehensive programme of activities to so successful a conclusion? Hundreds at least. Of what use would have proved that meagre handful of aircraft of that first squadron which accompanied the B.E.F.? They would have furnished but one small sector of the firing-line. It is unnecessary to labour the obvious. The development of aircraft in three years of war was without parallel. And this development was most satisfactory with regard to the flying personnel.

Man and machine grew up together. As the skill of the

aviator in manipulation grew into a fine art, the construction of the machine improved beyond expectation. But the man was ever the prime factor.

The sixty-odd antediluvian craft of the original R.F.C. holding at bay the hordes of latest equipped German planes in the first months bear eloquent testimony to this theory. And the many varying types—reconnaissance, contact, fighting—of pilots of the later stages of the war confirm it.

In a word, the battle airman was a practical man, not the hero of such stuff as only newspapers are capable of. He knew what to do, how to do it, and possessed the necessary physical energy to carry out the action. His development was that of mind and body, working simultaneously to the common object.

Physical fitness was the gospel of the R.A.F.; it was the first quality—and after it there were none others—of the successful airman in war. The "muddied oafs" and "flannelled fools" of those irresponsible pre-war days were unknowingly training for the greater game over the smoke and fury of the Flanders battlefield; they were banking physique. In flying the term "physique" was fairly comprehensive. It was not only, as has already been remarked, a matter physical and mental; but something more subtle, hidden like the great steel framework of a ship, something that provided the desired combination; the development of character and of self-restraint, of the subconscious sixth sense of intuition; waiting for, rather than weakened by, the sudden mishap. But physical qualities were the primary consideration.

Intricacies of Aeroplane Construction

Can one say the same of the machine he flew? Has an inanimate mass of wood and fabric such qualities? Aeroplanes, sympathetically handled, were almost human. They were beings of life and temperament. The construction of the later types of machine was as detailed and delicate as that of a watch; a Juggernaut constructed of the materials of a pack of cards. Strength from weakness as a problem of aircraft design was solved and insured by a thousandth-of-an-inch accuracy and maze of detail and skilful design; every component part the outcome of years of experience and the fruit of many brilliant

minds fitting one into the other like the parts of a watch. Stripped to the nethermost parts, the few feet of wood, steel, aluminium and linen supported a dead weight of engine of several hundreds of pounds. The engine propelled the craft at considerably over 100 miles per hour, the combination furnishing the power of flight. There were almost as many varieties of planes as there are of motor-cars; monoplanes, biplanes, triplanes; fighting-scout, reconnaissance and bombing machine; Camel, Pup and Dolphin; single, double, treble and quadruple engine craft. To ensure accuracy of construction a large body of men—almost an army in itself—was brought into being, known as the A.I.D., whose exclusive business was to inspect aircraft parts and finished machines. These parts numbered something over a thousand more than can be found in the average watch.

The Strain of Flying

The development of the craft was bound up indissolubly with the training of the man. In either case, each new and separate stage was as detailed and exhaustive as human nature could make it. It was more than warranted by results. Only imagine the strain on the human organs of the aviator; the strain of flying, day and night, over the terror of shell-fire, the waste of energy in the whirling *mêlée* of aerial combat. Head, heart and lungs had to be flawless in this incessant struggle, when the merest slip meant sudden and awful death. The airman was only in his prime between eighteen and thirty years of age, possessing good sight, and sound of body and limb.

Thus far, however, we have met only the man. His antecedents are still hidden. And if the tenacity and grit of the proverbial bull-dog carried the day at Trafalgar and at Waterloo, no less were the traditions and record of the Old Country being upheld by the New Service in the air. The Air Force was democratic—more democratic than any other of the British fighting forces. The personnel was recruited from every rank and every class of the nation, taken in bulk and developed through the refining process of the R.A.F. into the finished, full-fledged pilot and observer. Mostly this result

was achieved upon the native sense of sportsmanship, the knowledge of the right thing to do, the self-respect of fellow pupils. And here psychology played its part.

The infantry "sub" under the direct eye of his colonel and the command of his company commander was guided into the way he should go. Far overhead, skimming the clouds, his brother of the Air Force was his own colonel, company commander, rank and file in one. The plane he flew possessed the net destructive force of that same battalion. His radius of action was several times greater. Strategical as well as tactical was his *rôle*. A reconnaissance pilot at the first battle of Ypres retrieved the entire British Army. Allied planes at Ham stemmed the flood of advance of the German thousands and saved the world. That was his responsibility. The average age of the great British "aces" was twenty-one. Ball was only twenty when he died, McCudden twenty-three. Bishop retired at twenty-one, covered with honour and glory. And how many beardless youths fought a man's battle back to their own lines, maimed or mortally wounded?

The average airman—he will forgive me, I know—possessed a temperament, half woman, half artist. No human mind could find itself indifferent to so much adventure, danger and joy crowded into so little space of time. He was highly strung and imaginative—woe betide him if he were not. But, perforce, he had to gain the greatest of life's victories, discipline and self-restraint. His was a queer gift that combined such indiscriminate virtues as daring, obedience—an order disobeyed entailed grave accident, possibly death—enthusiasm, abundant physical energy, an aggressive spirit, mental alertness, and, above all, prowess in his craft.

There again was a unique combination that contained qualities unbelievable to those who have never shared the joy of flight. With the plane—and something on this nature already has been remarked—the good airman evinced a sense of "feel" much the same as a man may know of a horse or of a motor-car. He did not require artificial instruments to check his motions. Some subconscious force told him that. Even the flying pilots' methods of handling the machine varied as widely as the characteristics of their own handwriting. Some

manœuvred their craft as though those few feet of metal and fabric had been endowed with a divine gift of flight, delicately poised, quick to answer control as a thoroughbred racehorse. With others, flight was laborious, a matter of applied mechanics. Some were "stunt," some plain pilots. The former dashed about in the air, performing miraculous and hair-raising evolutions. But more often than not the latter were the greater airmen. For they flew by the golden rule in war, that victory went to the opponent who achieved the greatest amount of destruction with the least risk to his craft and to himself. And they realised that man and machine were both the achievement of arduous months of preparation, not easily to be replaced.

Penultimate Construction

In course of transition from raw material to finished plane the aeroplane passed through no less than sixteen large departments, exclusive of cost and progress departments, A.I.D., testing, and the purchase and transportation, by sea and by rail, of raw materials. A small army of women workers was engaged in the construction, in which also more than a score of skilled trades were represented, including electricians, metal beaters, tinsmiths, sail makers, motor engineers, varnishers, woodworkers, turners and machinists. The final cost of the plane varied between that of a Rolls-Royce and a private yacht. And every one of the five continents supplied at least one of the materials or fabrics.

Ash and spruce for the framework were imported from Russia and Canada; cotton, silk and linen for the fabric, from Egypt, China and Ireland respectively; aluminium, alloy and duralumin from France; oil from the United States; wool from Australasia; and petrol from southern Russia. The problem of demand and supply thus again resolved itself into a complication of native labour, shipping problems, several thousand miles of sea transport, and several hundreds by road and by rail. Practically speaking these raw materials could be classed under two main headings: wood and metal; engines and propellers were specialised branches of the aircraft industry. And every aeroplane manufacturer of substance employed at least one expert in timber, whose sole business it was to travel the country

in search of likely trees. Unhappily though, these home supplies diminished more and more as the war progressed, and competition grew keener.

Two Phases of Construction

The work of construction began with the designer. His art was the keystone to successful flight, his position the most vital —and, incidentally, the worst paid—of the aircraft industry. Like the work of the painter or of the author, or the poet, his was of the creative order. His pictures were fashioned from mathematical formula and experimental deduction. Designers did not achieve the same fame as the men who flew their machines, but their work was none the less vital to the new science of aerodynamics. Some of them lent their names to famous British planes, as A. V. Roe, de Havilland, and Handley-Page.

This preliminary work of the designer might be tabulated under the first of three general stages that made up the construction of the finished aeroplane. They were the "raw material" stage, the construction of the component parts, and the assembling of the machine. The plans of the designer passed on to the General Aviation Drawing Office, where they were converted, by means of a photographic process, into the familiar blue prints. There followed a lapse of some few weeks, perhaps months, while the plans were being considered by the mathematical adviser on practical issues, and knocked into shape to meet new requirements. From thence they were sent on to the Air Board experts for their approval, condemnation, or suggested alteration. In design alone several hundred alterations were possible. Complete, or nearly complete, aircraft drawings might be altered to some new development in wing-spread; perhaps a new engine. The entire machine had to be re-designed. Or, take another instance, the development of the engine. The authorities agreed that no aero engine could be perfected within a period varying from a year to eighteen months. The very latest engines of the very latest types of aircraft employed in the war were those of autumn, 1917. The alterations to the American Liberty engine amounted to over 2,500. Also standardisation was impossible. At the end,

almost every branch of aerial work was specialised, necessitated a specialised plane, usually an engine to match. For our present purposes, however, let us consider our designs as passed O.K.

From drawing offices to workshops proceeded innumerable blue prints, after the fashion of ultimatums; each print according to the particular portion of the machine it represented to the department it concerned. There was a continuous stir in the timber yard. Full-length trees and rough logs found their way to the mill, where the giant saws commenced to buzz, cutting and planing, fashioning into the requisite lengths and shapes. From foot-length giants to "baby" fret-saws, worked on springs like a sewing-machine, every tool played its part. The shop hummed with life like an angry beehive, until soon, smooth and white, gleaming like satin, in requisite lengths, the wood was ready for the more detailed development of the woodworkers' gallery.

The Work of the Women

Then on again to the metal shops, next door to which are women. Creation, by some freakish humour, fashioned the "weaker" sex for subtle handiwork, fingers deft and pliant to every detailed art. By further continuance of that humour she was now mainly responsible for the most lethal weapon ever known to war. Woman was there in force, row after row of her in overalls and caps of white and blue, rosy-cheeked and smiling, working with a will at the various parts; the touch of the eternal feminine peeping up on all sides—here a vase of fresh flowers, there a dainty powder-puff, strayed haphazard on the bench at her side. And, over the way, bravely facing the spluttering hiss of flame and metal, gloved and begoggled like a motorist, was her sister, the welder, an art in which, it may be said in passing, she excelled.

The Machine Shops

The next stage in the evolution of the plane is the machine shop—long, lofty buildings, reeking of oil and purpose, clattering with every latest invention and device of twentieth-century engineering. Bolts, screws, nuts were in the

making; machine-gun parts, engine framework, the thousand and one little details that go to the completion of the airworthy plane. Here also women played a noble part. And together wood and metal parts were sent over to the stores, which brings us to the end of the second stage, not counting the panel beaters, where real artists could fashion from rough sheets of metal anything from a Greek statuette to an engine-cowl, the "beat, beat, beat" of their hammers ringing incessantly like a chime.

It has been remarked already, the similarity of the aeroplane to the watch. Here is proof of the analogy—the stores. Without a mainspring a watch is a foolish toy. The mainspring to the aircraft industry was the stores department. It was the clearing-house, the bank deposit, the Alpha and Omega of factory organisation. Lynx-eyed men, inherently suspicious from birth, guarded by cage wire and imperturbable manner, dealt out parts as carefully as diamonds or gold-dust, missing no single detail, never forgetting to scrutinise requisition forms, or to obtain necessary signatures for goods delivered. An angel might err, but an aircraft storekeeper never! Every man among those heathen hundreds was guilty until his innocence had been established beyond an extra nut or a stray bolt. Behind the storekeeper, line upon line, shelf upon shelf, crate above crate, were exhibited his precious stores.

It worked, as old Bailey would say, concurrently. Wings were under construction while bodies were being assembled, and engines were already on the road from the special makers.

But, meanwhile, the A.I.D. was also busy, inspecting, and condemning or approving. They swept through the finished stores like wind through a wheat-field. Only the "full ears" withstood the blast. And stamped neatly with the blue imprint of the department, they were to be followed like pawns on a chessboard to the end of the game, to the time when the matured plane was soaring gracefully overhead. "Remember. A single slip may cause a brave man to lose his life," read the neat little white notice-board scattered profusely through every department, and this was the maxim of aircraft construction. Little

by little, without dangerous hustle, the faulty parts scrapped ruthlessly, the plane came into being in this final stage of "assembling."

Away out there in the dope shops—where the powerful odour of "pear drops" and turpentine pervaded the atmosphere—where formerly workers died by the score in contact with that deadly preparation, but where now the dope was "non-poisonous," and an elaborate and efficient system of ventilation carried away the fumes to the outer air—the fabric was covered with a greenish-grey preparation, that tautened like a drum and was impervious to every sort of weather. Then, in neat white figures, was painted on the number of the machine, and those essential red, white and blue markings of nationality, until, without undue ceremony, the engine—after a preparatory twenty-four hours' test-run on the bench—was installed in the fuselage, and the plane was ready for testing.

Glistening and gleaming in the sunlight, the new plane squatted on the cool, green space of aerodrome. The engine was started up with a rush and a roar. The test pilot from his seat waved a signal to the mechanics waiting with the blocks at the wheels. Out flashed the latter almost simultaneously. Jumping, hesitating, then surging forward on even course, gathering momentum with every yard, the machine climbed the sky, and a second later she was circling gracefully overhead, round and round, as though glorying in her efficiency and new-found power. Higher and yet higher she climbed, a dim speck on the horizon, now beyond hearing; a few clean banks and turns, perhaps a "loop" or so, then down came her nose. The pilot landed. She had passed her tests.

CHAPTER V

THE PERSONAL EQUATION

The Personal Equation—Schoolboy Knights of Valour—British Adaptability in the Air—Bishop's Air Fighting Methods—Flying, the Unusual—Bishop's Career in Brief—The Attack on the German Aerodrome—Other Unknown Aces—Exciting Photography—Hoist with his own Petard—A Human Balance Weight—Scattering a Column—A Matter of Will—Thanks and Anticipations.

"I HAD a quick impulse and followed it. I flew straight at the attacking machine from a position where he could not see me and opened fire. My 'tracer' bullets—bullets that show a spark and a thin little trail of smoke as they speed through the air—began at once to hit the enemy machine. A moment later the Hun turned over on his back and seemed to fall out of control. This was just at the time when the Germans were doing some of their famous falling stunts. Their machines seemed to be built to stand extraordinary strains in that respect. They would go spinning down from great heights, and just when you thought they were sure to crash, they would suddenly come under control, flatten out into correct flying position, and streak for the rear of their lines with every ounce of horse-power imprisoned in their engines.

"When my man fell from his upside-down position into a spinning nose-dive, I dived after him. Down he went for a full thousand feet, and then regained control. I had forgotten caution and everything else in my wild and overwhelming desire to destroy this thing that for the time being represented the whole of Germany to me. I could not have been more than forty yards behind the Hun when he flattened out, and again I opened fire. It made my heart leap to see my smoking bullets hitting the machine just where the closely hooded pilot was sitting. Again the Hun went into a dive and shot away from me vertically towards the earth.

"Suspecting another ruse, and still unmindful of what might be happening to my companions in their set-to with the other Huns, I went into a wild dive after my particular opponent with my engine full on. With a machine capable of doing 110 to 120 miles an hour on the level, I must have attained 180 to 200 miles in that wrathful plunge. Meteor-like as was my descent, however, the Hun seemed to be falling faster still, and got farther and farther away from me. When I was still about 1,500 feet up, he crashed into the ground below me. For a long time I had heard pilots speak of 'crashing' enemy machines, but I never fully appreciated the full significance of 'crashed' until now. There is no other word for it.

"I have not to this day fully analysed my feelings in those moments of my first victory. I don't think I fully realised what it all meant."

The simple story, the modest personal account, without undue exaggeration, the vividly expressed narrative of the details and sensations of an aviator's first encounter with an enemy machine in mid-air, are all characteristic of the modesty of the British aviator; and their author, perhaps most characteristic, certainly best known of them all—Lieutenant-Colonel Bishop, V.C., D.S.O., M.C., D.F.C., Legion of Honour and Croix de Guerre with palm.

Schoolboy Knights of Valour

In a war without precedent, the ethics of which were developed amidst incidents of daring and almost incredible adventures, thousands of feet up in the air, swaying dizzily betwixt heaven and earth, was born the British flying "ace." Schoolboy knights of valour were these: the one redeeming human element of the most barbarous and bloody war in history. Sky and cloud were their tourney ground, where no quarter was given and none asked. Mounted upon highly sensitive steeds of wood and metal, the most skilful and delicate of twentieth-century inventions, the story of their glorious deeds ranks unequalled down the long history of chivalry and daring. Peer to this brilliant coterie, Captain Albert Ball, V.C., D.S.O., M.C., after a brief but dazzling and world-

famous career, paid the supreme penalty for his daring. He died at twenty, a boy in years, and, to the last, a boy at heart, yet a veteran of the air. With forty-three German machines to his score, he flew away into the sunset of a red-gold summer's evening, never to return.

At Annoeullin, in a small pear orchard beside the long grey highway, as has already been told in this work, Ball was reverentially buried by the Germans. But the spirit of the man was to continue for ever. While the whole civilised world had been ringing with his glorious exploits over the serried Flanders battlefields, there was in training in England a young and unknown Canadian captain, who took to flying because he did not like the mud of the trenches! The cloak of Elijah was to fall upon the shoulders of Elisha. Lieutenant-Colonel W. A. Bishop was to excel even Ball's unique record of "downed" Hun planes.

Bishop, by a strange coincidence, immediately he arrived in France from his training course in England, was appointed to Ball's own squadron. But they never met. Both were ideal battle pilots, both ideal leaders of men. Little doubt at all there can be that the young Canadian derived no little inspiration from the deeds of the even younger but more experienced Englishman. One golden rule of air fighting he did learn. Ball was the first to put it into practice, and it was to hold good until the time of the signing of the Armistice. By this dictum it was held that the prime craft of the battle airman lay in the skill with which he could execute damage among the enemy's aircraft and military positions, with the least risk of injury to his own machine. To gain a dashing victory in the air at the price of an often irreplaceable craft, and often the pilot's own life, was a defeat of the worst nature. The great battle airman was never the most reckless, not the most daring, nor the most successful—if sensational exploits are held to any account—but rather the pilot the longest to stay the course, regularly and systematically doing harm to the enemy's cause, whether by land or by air. Strictly speaking, neither Ball nor Bishop could be accredited great pilots; but they were steady, and, above all, both of them were great shots with their machine guns. They could bring an enemy pilot down with half a

drum less than any other pilot on the air battle fronts. Therein lay the secret of their success.

To continue the human equation a step more forward. As a nation the British were the most adaptable of all belligerents. Where, for the German, aviation was merely some new form of military duty, carried out by number and by rote of text-book; and the Frenchman was apt to regard it as a reckless, breathless, and immediate means to ultimate victory, the average English airman took to flying as a matter of course. It was the secret of his success in the air, his very nonchalance. In the most daring of his deeds, unless the newspapers and soft-mouthed politicians thrust it upon him, there was nothing of the heroic. He was apt to regard a trip over the lines in much the same light as a motor drive through the park. History will show, as the story of the sea already bears witness, that the Englishman's adaptability will make him the finest airman in the world. That is why, in the war, the British battle pilot very soon proved himself the equal of five enemy airmen, and the fact that almost every one of them evolved some definite policy of attack and defence. In a word, they used their heads as well as their hands and machines.

Bishop's Air-fighting Methods

Ball initiated the first policy of aerial combat. Bishop carried it forward yet another step. "To be successful in fighting in the air," he said, "two things were required above all others. One was accuracy in shooting, and the second was to use one's head and take no unnecessary risks. Consequently my plans from about this time forward were to take a minimum of risks, and whenever things looked at all doubtful or bad immediately to make my escape and wait patiently for another opportunity. The patience part in carrying out this campaign was the hardest, but I managed to control myself, and found it much more effective than constantly blundering into danger like a bull in a china-shop."

He goes on to give an actual instance of how he carried this very wise policy into effect. "For instance, one day I saw a single enemy scout flying at a tremendous altitude. I

DEATH IN THE AIR

The dramatic death of a German pilot is here shown. Shot through the heart, his fingers still clutched the trigger of his gun and his machine "zoomed" upwards, the gun firing as it went, until at last it turned completely over and went crashing to the ground.

climbed up carefully some distance from him, and got between him and the sun; then, waiting until he was heading in exactly the opposite direction, I came down with tremendous speed and managed to slip underneath him without even being seen. I could make out each mark on the bottom of his machine as I crept closer and closer. My gun was all ready, but I withheld its fire until I came to the range I wanted—inside of twenty yards. It was rather delicate work flying so close under the swift Hun, but he had no idea that I was in existence, much less sitting right below him. I carefully picked out the exact spot where I knew the pilot was sitting, took careful aim, and fired. Twenty tracer bullets went into that spot. The machine immediately lurched to one side and fell.

"I had quickly to skid my machine to one side to avoid being hit by the falling Hun. After he had passed me a little way, I saw him smoking. Then he burst into flames. That pilot never knew what happened to him. Death came to him from nowhere."

Flying, the Unusual

If one were to take a concensus of opinion of the main characteristic of war flying, it would be that it was unusual. It was a thing apart from man's general conception of war. At the outbreak of hostilities the aircraft was nothing more than a toy. At the conclusion of hostilities it was a dominant factor in the Allied victory and the German defeat. The enemy lost because, even by the time of the signing of the Armistice, nationally he had not accustomed himself yet to the vagaries of aviation. And they were many.

Even the periods of greatest activity in the air were opposed naturally to the normal order of things. Most of the aviators' patrols were carried out—the most important ones at least—in the cold grey light before the dawn. Fifty per cent. of the work of the belligerent air forces was done by night. If that were not sufficient, here was a human being suspended for hours on end in a tiny cubby-hole, in which there was barely room to turn to the right or to the left, suspended dizzily in mid-air. Bishop tells something of this feeling in the personal account of his meteoric twelve months as a battle airman on

the Western Front. As typical of the best type of British airman of his time, Bishop's career is worthy of record.

Officially credited with having brought down seventy-two German machines, this great little Canadian unofficially claimed to have accounted for over a hundred German aircraft in that short period. In his own words, he was "lent to the R.A.F. for flying purposes."

His greatest feat in the air, for which he was awarded the Victoria Cross, was a single-handed attack on several German aerodromes at the dawn of a midsummer's day. Despite the earnest entreaties of his friends—he himself admits: "They were not entirely in favour of the expedition, and said so again"—he set out from his home aerodrome at 3 A.M. "I flew across the lines," he reported afterwards, in a modest attempt to explain away this daring incident as a matter of daily routine, "towards the aerodrome I had planned to attack, and, coming down low, decided to carry out my plan and stir them up with a burst of machine-gun fire into their hangar sheds. But, on reaching the place, I saw there was nothing on the ground. Everyone must have been either dead asleep or else the station was absolutely deserted. Greatly disappointed, I decided I would try the same stunt some other day on another aerodrome, which I would have to select.

"In the meantime, for something to do, I flew along low over the country, in the hope of coming on some camp or group of troops so as to scatter them. I felt that the danger was nil, as most of the crews of the guns which ordinarily would fire at me would still be asleep, and I might as well give any Huns I could find a good fright. I was in rather a bad temper at having my carefully laid plan fall through so quickly, and nothing would have pleased me better than to have run across a group of fat Huns drilling in a field, or something of that sort. However, nothing appeared, and I was just thinking of turning and going home, or of climbing up to see if there were some Huns in the upper sky, when ahead, and slightly to one side of me, I saw the sheds of another aerodrome. I at once decided that here was my chance, although it was not a very favourable one, as the aerodrome was pretty far back from the lines. To make good my escape from this place

would not be as easy as I had hoped. Furthermore, I was not even certain where I was, and that was my greatest worry, as I was a bit afraid that if I had any bad fights I might have trouble in finding my way back. Scurrying along close to the ground, zigzagging here and there, one's sense of direction becomes slightly vague.

"Another half-minute and I was over the aerodrome, about 300 feet up. On the ground were seven German machines, and in my first glance I saw that some of them actually had their engines running. Mechanics were standing about in groups. Then I saw a thing which surprised me very much —six of the machines were single-seaters, and one only a two-seater. I was not very anxious for the two-seater to come up to attack me, as in taking off he would have a certain amount of protection from behind, with his observer, while the single-seater could have none. However, in this, luck also favoured me, as the two-seater did not move at all.

The Attack on the German Aerodrome

"I pointed my nose towards the ground and opened fire with my gun, scattering the bullets all round the machines, and coming down to fifty feet in doing so. I do not know how many men I hit or what damage was done, except that one man at least fell and several others ran to pick him up. Then clearing off to one side I watched the fun. I had forgotten by this time that they would, of course, have machine guns on the aerodrome, and as I was laughing to myself as they tore round in every direction on the ground, like people going mad or rabbits scurrying about, I heard the old familiar rattle of the quick-firers on me. I did not dare go too far away, however, as then I would not be able to catch the machines as they left the ground, so turning quickly and twisting about, I did my best to evade the fire from the ground. Looking at my planes I saw that the guns were doing pretty good shooting. There were several holes in them already, and this made me turn and twist all the more. Then one machine suddenly began to 'taxi' off down the aerodrome. It increased its speed quickly, and I immediately tore down after it. I managed to get close on its tail when it was just above the

ground, and opened fire from dead behind it. There was no chance of missing, and I was as cool as could be. Just fifteen rounds and it side-slipped to one side, then crashed on the aerodrome beneath. I was now keyed up to the fight, and turning quickly saw another machine just off the ground. Taking careful aim at it, I fired from longer range than before, and I did not want to waste the time by going up close. For one awful moment I saw my bullets missing, and aimed still more carefully, all the time striving to get nearer. The Hun saw I was catching him up, and pushed his nose down; then, gazing over his shoulder at the moment I was firing at him, he crashed into some trees near the aerodrome. I think I hit him just before he came to the trees, as my tracers were then going off in an accurate line.

"I again turned towards the aerodrome. This time my heart sank, because two machines were taking off at the same time and in slightly different directions. It was the one thing I had dreaded. There was not much wind, and it was possible for them to do this. I had made up my mind before that if they attempted to do this I would immediately make good my escape, but I had counted on being higher. However, true to my intention, I began to climb. One of the enemy machines luckily climbed away at some distance, while the other made up straight for me. At 1,000 feet, and only a few hundred yards from the aerodrome, I saw that he was catching me, so I turned on him and opened fire. We made about two circuits round each other, neither getting a very good shot, but in the end I managed to get in a short burst of fire, and this machine went crashing to the ground, where it lay in a field a few hundred yards away from the aerodrome.

"The fourth machine then came up, and I opened fire on him. I was now greatly worried as to how I was to get away, as I was using up all my ammunition, and there seemed no end to the number of machines coming up. I was afraid that other machines from other aerodromes would also come in answer to telephone calls, and I wanted to get away as quickly as I could. But there was no chance of running from this man —he had me cold—so I turned at him savagely, and in the course of a short fight emptied the whole of my last drum

at him. Luckily, at the moment I finished my ammunition he also seemed to have had enough of it, as he turned and flew away. I seized my opportunity, climbed again, and started for home.

"To my dismay I discovered four enemy scouts above me. I was terrified that they would see me, so flew directly underneath them for some time—almost a mile, I should think—going directly south. Then, deciding that I must do something, I took the bit in my teeth and slipped away. They did not attempt to attack me at all, so I am not sure whether they even saw me or not.

"I now headed in the approximate direction of our lines, and flew in rather a dazed state towards them. I had not had any breakfast, and was feeling very queer in my stomach. The excitement and the reaction afterwards had been a bit too much, as well as the cold morning air. It seemed once or twice that my head was going around and around, and that something must happen. For the only time in my life it entered my thoughts that I might lose my senses in a moment and go insane. It was a horrible feeling, and I also had the sensation that I would suffer from nausea any moment. I was not at all sure where I was and, moreover, did not care. The thrills and exultation I had at first felt had all died away, and nothing seemed to matter but this awful feeling of dizziness and the desire to get home and on the ground.

"By the time I reached the aerodrome, however, I felt much better, and flew over our still sleeping huts, firing off my signal lights frantically to show them I had certainly some success. I landed, and my sergeant immediately rushed out and asked me how many I had bagged. When I told him three he was greatly pleased, and yelled it back to the mechanics who were waiting by the shed. Then as I crawled out of my machine I heard the remarks of the mechanics around me. They were looking it over. Everywhere it was shot about, bullet-holes being in almost every part of it, although none, luckily, within two feet of where I sat. Parts of the machine were so badly damaged as to take a lot of repairing; but I used the same patched planes in the machine for some time afterwards, and always felt a great affection for it for pulling me through such

a successful enterprise. I personally congratulated the man who had had charge of my gun, suddenly realising that if it had jammed at a critical moment what a tight corner I would have been in."

Brilliant as was this great exploit of Bishop the Canadian, brilliant as modestly he described it, not less noteworthy were the achievements of other lesser-known British aviators in those autumn months of 1917. Wisely or not, the policy of the R.A.F. authorities throughout the war was anonymity. There was many an unknown Ball, and a Bishop or so, whose only acknowledgment was the ungrudging memory of his companions. The day when Bishop earned his Cross, for instance, in other parts of the far-flung air line other pilots and observers of other squadrons were adding to their laurels.

A British machine—the instances are chosen at random from the official reports—was detailed to bomb a special objective. The pilot reached his destination and, in spite of a very heavy anti-aircraft fire, proceeded to glide down in order to make certain of hitting his target. As he got lower the fire increased in intensity, and the pilot was badly hit. He reached his desired position, however, released his bombs, and then proceeded to make for home in the face of a strong westerly wind.

By this time he had lost a good deal of blood, and his observer, noting that he was in a fainting condition, climbed on to the cowling and assisted the pilot to fly the machine. Three times the pilot fainted completely, and, falling forward, rendered the observer's control extremely difficult. In spite of this, between them the two British officers succeeded in crossing the lines, and landed the machine safely in their own aerodrome.

Exciting Photography

The photographic work of the Royal Air Force did not perhaps furnish those opportunities of personal distinction that offered themselves to fighting scouts, for officers on photography work were definitely forbidden to fight except defensively. At the same time the work was by no means devoid of excitement, as is shown by the following typical incident:

A British plane reached a certain area well over the German

lines, where some special photographs had to be secured. No sooner had the observer begun his work than a formation of German machines swooped down and attacked. The British pilot, obeying orders, made for his own lines—fighting a rear-guard action as he did so—as a result of which one German machine went down in flames.

Immediately the enemy machines disappeared, the British machine recrossed the lines, reached the objective, and recommenced work. Again it was attacked, this time by eight Fokkers. In the course of a second retreat the British officers brought down one more German machine. The appointed task had not yet been completed, so once more the British machine returned to the hostile area, where all the photographs were successfully secured.

Hoist with His Own Petard

On another occasion a British scout machine roaming the skies in search of night raiders suddenly perceived a German bombing machine twisting and turning in the grip of several British searchlights.

Immediately the British pilot dived to the attack, and after some manœuvring succeeded in getting into firing position at only a few yards' distance. From here he put in a strong burst of machine-gun fire. The German machine burst into flames and began to flutter earthwards like a huge burning leaf. Suddenly the British machine rocked in the concussion of a tremendous explosion, and the German raider vanished in a blinding flash. One of its own powerful bombs had exploded, blowing it to pieces.

A Human Balance Weight

Whilst on patrol another—a British two-seater—sighted a number of Fokker biplanes, which were immediately engaged. Dashing into the German formation, the British pilot succeeded in sending one Fokker spinning to earth. The Germans had by this time recovered from their surprise and made a concerted attack upon the daring British plane, pouring in a perfect hail of bullets. Though the British pilot manœuvred very swiftly to throw the enemy gunners off their mark, one unlucky burst

severed the left aileron wires of his machine, so that it fell in a sheer side-slip for 2,000 feet.

The observer, clearly and coolly realising the danger (he had been wounded), climbed out on to the bottom plane, and by the nice and calculated manipulation of his own weight restored the balance of the machine. By remaining out on the plane during the whole flight this wounded observer enabled his pilot to bring back and safely land the machine behind the British lines.

A British pilot returning from a successful bomb raid, in which a German aerodrome had been very severely damaged and a direct hit secured upon a moving train, saw far below him a German convoy of about forty guns and wagons headed by a staff car.

Swiftly diving, he opened fire on the long column. The effect was extraordinarily successful. Apparently the driver of the staff car was first hit, for the car dashed into the ditch, overturned and burst into flames. Many drivers and horses were hit, and the remainder, terrified by the machine overhead, stampeded, some piling themselves upon the leading vehicles, and others scattering over the surrounding fields, where many more guns and wagons were overturned. The casualties in personnel were numerous. Bishop would have fancied such another of these daily adventures. It happened during the Cambrai battle.

The Germans were known to be gathering troops for a counter-attack, and to be making great use of the railway junction at Douai, which was then some twelve miles east of the British lines and uncommonly well defended by barrage fire against aircraft.

Orders were issued to bomb the junction at Douai, and an aeroplane set out to obey the order. It was a steady old machine, but without dual control. It crossed the lines, went beyond the objective, and then glided down with engine "cut off" to about 600 feet. The defence, it seemed, had gone to sleep, for nothing was seen except a few searchlights, which the aeroplane had no trouble in evading.

The British airmen reached their station in the air above the junction and dropped their bombs. Then they discovered

that the Hun was less sleepy than he had seemed, and a perfect hurricane of tracer bullets, "flaming onions," and Archie shells burst around them.

The machine escaped injury in any vital part (it is wonderful through what fire an aeroplane could fly without serious damage), but a bullet entered the pilot's arm by the elbow and left it by the shoulder.

Now duty is a tremendous force and compels a man to carry on when every instinct in him is pleading for respite; but there comes a stage when pain conquers all and a sufferer can think of nothing but to reach relief from his suffering. Reason then is eclipsed, the sense of duty vanquished, and a soldier is a primitive suffering human being with no other thought than to find relief for his pain.

The pilot had reached that stage. It might be in the "enemy's country," with all its unpleasant implications, in which he would descend; still, he wanted to descend.

But there were two wills in that aeroplane, the observer's as well as the pilot's, the one fresh and strong as the other was tired and weak. Good manners didn't matter. "We'll land in our own lines," said the observer with emphasis, and his will wrought on the other's till the pilot fought his pain away and tried to fly for the British aerodrome.

Pain cannot be urged away. It cannot even be cursed away. And the pilot fainted.

It was impossible for the observer to reach the rudder bar, but he could just grasp the control-stick, and what happened to the bar depended on the unconscious pilot's feet. Fortunately the machine flew straight, and they rose slowly out of the hell of the barrage.

The observer congratulated himself, and the fact that, as they flew west, the Archies fired freely hardly troubled him. He had other things to think about. Then the pilot came out of his faint—weak, suffering, and strong only in his desire to escape his pain.

The tussle of will began again. Again the pilot was forced by the stronger will to fly the machine, and again he fainted.

They were crossing the lines by now at about 2,000 feet,

flying into the wind, with the observer grasping the control-lever and keeping her going, which was all he asked of fate.

The pilot chose that moment to recover.

"Can you land her now?" the observer asked.

"Yes," said the pilot, and the observer gave over control to him. But the wounded man was unequal to the strain, and suddenly the machine dived steeply as he relapsed into unconsciousness.

Ahead of them the observer saw a patch of trees, and he pictured the coming crash. He meant to escape those trees if he could, and "yanked" the control-stick hard. The machine, with its last remnant of flying speed, leapt the trees, and crashed not fifty yards farther on in a field.

They were on land, and in the British lines. Also, as far as the crash went, they were unhurt.

Within ten minutes the pilot was on his way to hospital, and the observer was telephoning his report of the bombing of the railway junction to his squadron commander.

And if, perchance, the positions of the two men had been reversed, that pilot would have done as that observer did; no less. It's a way they had in the Air Service.

Thanks and Anticipations

One might imagine that the telling of these incidents would pall because of their similarity. Yet they do not. For they are not similar. Elemental facts are ever the same. Only personalities differ in every case. Wherever the veil of official secrecy is lifted but a little, wherever the human factor enters in, there is offered an intriguing glimpse of the purpose, grim and dour, yet with ecstasy of sheer youth breaking through like a strayed golden shaft of sunlight piercing the massed and heavy storm clouds, of the unconquerable will that was victory in the air war, and of the deft skill which neither danger nor misadventure could balk. Every one instance would appear to eclipse the last; every one more wonderful, more the plaything of the imagination than stark, real fact, hallowed by glorious sacrifice and sanctified in human blood, until even Lord Curzon's glowing tribute in the House

of Lords, November, 1917, at first sight would seem insufficient.

"Nowhere in this country," said Lord Curzon, "has the spirit of knight-errantry been more conspicuously shown. When, in August, 1914, 100 officers and 66 machines made their way to France, who could have foreseen that they would have developed into a great fleet of thousands of machines and tens of thousands of men? On the Western Front, in the first nine months of 1917 the men of the Royal Flying Corps brought down 876 enemy machines; they drove 759 out of action, 52 were brought down by anti-aircraft gunners; thousands of tons of explosive were dropped on aerodromes, bridges, railways, lines of communication, and even on marching regiments. Apart from offensive operations and activities of the Air Service, they are the eyes of the army in the field. Then we must not forget the airmen at home, who have shattered the enemy's Zeppelins, and by their skill and bravery on many occasions have brought those great gas-bags in flames to the ground. I sometimes think, when Gothas are shrieking over London, and when the civil population are cowering in their cellars, we might give a thought to those brave men who are riding in the darkness above and risking their lives to save us from destruction. I include in the same tribute the officers and men of the Naval Air Service. There is no distinction between the two Services. At the beginning of the war the personnel of the Naval Air Service was 800, and now it is 42,000. Its fleet in August, 1914, consisted of seven airships, thirty aeroplanes, and thirty-four seaplanes; whilst the number is now many thousands. The most effective branch of the Service has been the naval squadron of Dunkirk, from whence it has bombed aerodromes and has diminished and at times stopped the aerial invasion of our country.

"These airmen have been in evidence in every theatre. They have flown over Damascus, dropped bombs on Beyrout, destroyed buildings in Constantinople; and their flight to the Lake of Constance in the early part of the war and destruction of sheds there will be remembered."

CHAPTER VI

GERMAN TRIUMPH AND DEFEAT

The One Redeeming Feature—Germans Admit Reprisals—On the Down Grade—Effort to Recover Prestige—Deaths of German Aces—More Types of German Aeroplanes—Work on the Western Front—A Case of Mistaken Identity—Daily Activities of the German Aviators—The Autumn Temporary Recovery—Work of the Naval Airmen—First Signs of Panic—Last of the Zeppelins—A Coup Disastrous—Three Years' Air War, according to Germany.

It is interesting to record the one protest made in the German Press against that Government's ruthless campaign of intensive bombing raids on the defenceless cities of Britain. Previously suppressed by the commander of the fortress for its outspoken views on the war, or rather the methods of its military commander in the making of it, the Socialist Breslau paper, *Volkswacht,* devoted its swan-song to the following protest against the scandalous air attack on the civilian populace of London in early June, 1917 :—

"Twenty-five dead men," said that temerous journal, "16 dead women and 26 dead children, and 223 men, 122 women and 24 children wounded: that is the result of the attack on London, besides devastation of material, perhaps also of a military character. One must be seized with horror in imagining, even from afar, the effect which such a bomb produces in a children's school class, the killing of ten of these little things on the spot, and the battering and maiming of others. One can share in the collapse of mothers who find their darlings thus while the husband, perhaps, is out at the front facing the enemy, and one can hardly conceive the rage which naturally follows such an event and is directed against its authors. Truly our British comrades have not an easy task, namely, in the face of such popular feeling to go to Stockholm and

negotiate with their 'enemies.' It is a miracle if they are not lynched and torn to pieces in such a moment of fury."

Alas for every ideal, however. The facile penitence of words was a not too subtle cloak of the mental foresight with which this socialistic intelligentsia, alone of all classes of the German civilian population under the blind blood-and-iron régime of military dictatorship, was blessed. The *Volks-wacht* saw—and truly read—the writing on the wall. It glimpsed the warning storm-clouds gathering on the horizon of war. It realised but too well that what the German airmen had initiated in this most bloody and merciless phase of the war, the Allies could imitate, and develop, and return a hundredfold; that as those dark sombre shapes swept out across the sky-line on their grim mission, so, some fine day in the not too distant future, ten, a score, hundreds of Allied machines would return, swarming over the thickly populated Rhine towns to repay Germany in her own coin.

German Fear of Reprisals

Unconsciously, also—and only she could have remained unconscious of such a fact—dog-like, the entire German Press was beginning to nose that fear. Well aware that some time during the new year the American squadrons would be coming into action on the Western Front, the Germans already were straining every nerve in order to be able to meet the Allied air offensive of the coming spring. At the same time the British air-raiding squadrons were carrying the war in the air home to the enemy in the most uncomfortable fashion. While the Germans, doing their utmost to build up a gigantic air service, at the express order of headquarters, were being recommended to use their airmen and machines, for the moment, as economically as possible. An order, signed by General von Ludendorff, dated June, which came into the hands of the French Intelligence Service, stated that the Allies were employing their aeroplanes economically with a view to the great battles of the future. It continued: "We should be wrong to overwork and wear our air formations, which are inferior in numbers, by sending them out several times every day. Consequently, the infantry and artillery must be told that it

is impossible to prevent the enemy's planes from flying over our lines, and they must not get nervous when they see them overhead. Airmen are to be used sparingly in calm times in order that Germany may have as many of them as possible for great emergencies." But it was the unconscious fear of Allied reprisals which ever held uppermost in the German mind at this time.

The enemy hints of coming German losses of ground in the West, and the "strategic retreat according to plan," which of late had begun to creep into the columns of the German press, now gave way to an entirely new phase. This was the fear of a great Allied aerial offensive which would follow inevitably the German evacuation of Belgium. Perhaps it was best voiced in the plaint of the *Vossische Zeitung* that "a base in Flanders would enable England to annihilate with her air squadrons the whole of our industrial basin, and to drive Germany completely from the seas. German industry would be at her mercy. We must hold our positions between the sea and the Lys, or we shall lose the war entirely. The fate of Germany is now being decided in Flanders."

More German Admissions

This implied confession that Germany recognised that the war in its final stages would be won or lost by the use of aircraft marked a distinct drop in the enemy tone of self-assurance. Moreover, it showed distinctly that Germany was beginning to lose faith in her much-vaunted aircraft.

Meanwhile, so effective had proved the R.N.A.S. raids on Ghistelles, the largest and most important of the German air bases in Belgium, that, according to the statements of captured German aviators, about this time it was partially dismantled, because its personnel, which was being bombarded incessantly day and night, would not remain there any longer. Still more serious dissensions prevailed between the reconnoitring and chasing squadrons. Non-commissioned officers were now declining to join the air service, as, even when they were promoted to be officers, they were systematically ignored by their observers, and because favours and rewards were only given to regular officers; and successes won by non-commis-

TWO AGAINST TWENTY

In the later stages of air fighting the British pilots usually found themselves engaged against odds, for the enemy would hardly venture out save in large numbers. This picture shows two British planes attacking and beating off twenty of the enemy.

(From a picture by Joseph Simpson.)

sioned officers, or even by officers who had risen from the ranks, were accredited not to them, but to the commander of their squadron.

Along the Belgium coast, week in, week out, night after night, with only short intervals, the German anti-aircraft guns were in action, and every few minutes could be heard the louder explosion of bombs. Innumerable Allied machines were to be seen crowding the skyline, in the moonlight or in the brilliant beams of countless searchlights. The civilian population's rapidly growing panic could be seen reflected in the pompous tone of the German official *communiqués*.

Germans Admit Reprisals

On September 18th, Main Headquarters reported:—

"Our enemies undertook several bombing raids on September 16th against South German territory. Stuttgart, Tuebingen, Freudenstadt, Oberndorf, Saarbrucken, and Colmar were attacked. Near Stuttgart one soldier was slightly wounded. At Freudenstadt and Colmar damage was done to buildings. None of the other attacks caused either losses in killed and wounded or material damage. Three of the enemy aeroplanes were shot down on German soil."

And again, on October 4th, it was stated that:—

"Enemy airmen, during the night of October 2nd, attempted in numerous flights to make attacks on German soil. The attacks did not produce results of any kind. An enemy aeroplane came as far as the neighbourhood of Stuttgart and dropped at Feuerbach six bombs, which caused small damage, but no casualties. The Lorraine industrial region was subjected to numerous attacks, which, however, as usual, thanks to our effective measures of defence, had only slight success. Only one airman again succeeded in penetrating into the region of Dortmund (near Essen). He dropped on the railway at Dorstfeld (Dortmund South) six bombs, which damaged the tracks. In this attack one person was killed.

"One of the enemy airmen who during the night of October 2nd attacked Frankfort was on the return journey forced to descend by German anti-aircraft measures. He is a sergeant, and his machine was a Sopwith one-seater, No. 128.

Some attacks during the night of October 2nd were also directed against Rastatt, Baden-Baden, and Tuebingen. Three bombs were dropped on the first two places, causing some material damage. For what purpose the French make these attacks on open German towns is unclear. In Rastatt there are no military objectives, and the attacks on Tuebingen and Baden-Baden can only be considered as the outcome of a blind desire for destruction. The sanatoria at Baden-Baden and the hospitals at Tuebingen contain numerous severely wounded men who are seeking recovery. Even the French will not dare to assert that attacks on hospitals far behind the front are of military necessity. By such barbarity the will to persevere can only be strengthened in the German people."

On the Down Grade

The climax had been reached, and passed, of three tremendous years of aerial combat, during which, for the better part of the time, the Germans had held a decided mastery of the air. This effort may be said to have touched high-water mark in the early autumn of 1917. One of the most capable of the younger generals—von Hoppner—had been appointed Commander-in-Chief of the Air Service, and his influence was not without its effect on every branch of the German air war. The latter was at the height of its power. Yet by Christmas that same *moral* had fallen to an alarming degree.

Many various causes contributed to this sudden decline. Chiefly it was due, however, to the heavy casualties suffered by the leading German battle-pilots, and a sudden shortage of aircraft and of trained and experienced personnel. Also there was, as already stated, the very prevalent fear of America's advent into the war. In the air, markedly in advance of the Allies at the beginning of the war, Germany was at the time of the Battle of the Somme no less markedly behind them in this phase. General von Bulow admitted it plainly in an alarming report.

"An effort to recover at least an equality was at once begun," Mr. G. H. Perris reported from General Headquarters in November, "and it was further stimulated by the entry of the

United States into the war and the fear of what that would presently mean.

"Various favours were accorded to aviators, and thousands of vigorous men were attracted into the service. The manufacturers were stirred up, and by the end of last August thirty new aeroplanes and hydroplane factories had been established, while the older makers had greatly extended their works. The chief attention was given to squadrillas of chasing planes and bombarding groups. The Albatros and other types were standardised. The Gotha works at Erfurt received large orders, especially for their three-seater, double-motor bombarding plane.

"The best Benz and Mercédès motors were also standardised, and the personnel of the hangars was enlarged, a squadrilla of six planes having attached to it 100 and even 120 men. Among other types favoured may be mentioned the light and rapid Halberstadt-Rolland, the Fokker triplane, also a rapid riser, the 1917 Rumpler with a Mercédès 260 h.p. motor, which is at present the best German scouting plane, and a new 'Junker' machine, with a wholly metallic body, which is intended to cover the infantry advance. The two-motor bombarding planes can carry 16 cwts. of bombs, and can rise to three miles' height in forty minutes.

"The service enjoys such advantages as belong to a practical dictatorship. And yet the only direction in which it has decidedly scored is that of promiscuous slaughter in London and in such French towns as Nancy, Dunkirk, and Bar-le-Duc. On the front we maintain our superiority. In all of the French offensives of this year, particularly at Verdun and on the Aisne, it has been clearly shown, and on several critical occasions the enemy planes have been practically driven from the field. In a recent list of 'Aces' there are 48 French names (37 of the men being alive and 11 dead or disappeared), as against 57 Germans, of whom, however, 29 were in the latter category, so that our Allies had a considerable superiority in surviving champions."

Effort to Recover Prestige

A superhuman effort was made to recover this lost prestige during the winter of 1917-18. During the six months from

February to August 29th several important industrial establishments were added to the number of factories making aeroplanes or their accessories in Germany.

Simultaneously with this great increase in the output of machines, the Germans were looking everywhere for recruits for the flying service. Applications for transfer to the air service were received from both infantry and engineers, instead of being restricted to cavalry as was the case not long before. Applications were dealt with in a month instead of two months, and there was no doubt that, in the course of the year, the personnel of the German air service was largely reinforced. Volunteers were wanted for the fighting planes, because it was chiefly among the fighting squadrons engaged on the battlefields that casualties occurred, but a large number of officers were being trained as observers for observation planes.

The number of German battleplanes was doubled, and the aeroplane and motor-building factories throughout Germany were enlarging their plant and obtaining reinforcements of labour to enable them to cope with the sudden influx of orders.

Switzerland was laid under contribution. Two hundred and fifty Argus motors were ordered from a firm in the Zurich district. The Fokker firm, which was building fighting biplanes in great numbers as well as a triplane remarkable for its speed and climbing powers, took over the great Berzina piano factories in Schwerin.

For bombing formations heavy three-seater machines were being built which could carry between seventeen and eighteen hundred pounds weight of bombs. They had Mercédès 260 h.p. motors, and when loaded could climb 12,000 feet in thirty-five minutes. In every type of flying machine the Germans feverishly were producing new models for long-distance scouting expeditions. The Germans were also using a new six-cylinder Maybach motor, developing 240 h.p., which was noticeably lighter than the ordinary Mercédès and gave greater speed in climbing. A big German machine which landed in Holland about this time was discovered to be fitted with an electrical installation, driven by motor, for the purpose of warming the airmen.

As balancing this great effort, the Germans at this time lost

some of the most noted of their battle airmen. Lieutenant Gontermann, who was credited with having brought down 39 Allied machines, was killed at Siegen aerodrome on November 3rd while trying a new machine. Lieutenant Hohendorff, who was last mentioned in the German *communiqués* in July with his eleventh Allied machine and the award of the Pour le Mérite, had learnt to fly at a French school, disguising his nationality as Swiss, in 1903, and was shot down by a British pilot in France during the first week in September. The most romantic story of the German air service was that of the death of Riessinger, who had, before he met his fate, shot down four British machines. During his last fight it is asserted that the noted airman succeeded in setting fire to the machine of his British opponent, but the latter, seeing that he was unable to escape death, rammed Riessinger's machine, with the result that both airmen fell to the ground.

Plans of Land and Sea Aerial Campaign

Neither loss of craft nor of yet more valuable personnel, however, deterred the German aviation authorities from their proposed programme. The work of the aircraft over the various battle fronts was carried out by the military airmen; at the same time, the naval aviators were responsible for the sea patrols and for the air expeditions against the British Isles and France.

The military had all their hands full in beating off the determined and continuous attacks of the British airmen, but yet managed to spare a small number of machines to operate on the Russian front.

On August 6th German air squadrons on the Courland coast attacked the military factories at the mouth of the Dvina and the Island of Oesel. Good results were achieved, and all the German aeroplanes returned undamaged. The important Russian naval bases at Lebara and Arensberg had been dealt with a month previously. On this occasion several military buildings near the docks were almost entirely destroyed.

During May the German flying corps had distinguished itself by the brilliance and manifold quality of its undertakings. Among those who had especially distinguished themselves in

addition to the battle and infantry airmen were artillery directing pilots, who made themselves almost indispensable in assisting the fire and observation services. In the West, the East, and in the Balkans, the Germans claimed during May: "We lost 79 aeroplanes and 9 captive balloons. Of the enemy aeroplanes shot down, 114 are behind our lines and 148 were seen to fall behind the enemy positions. Further, the enemy has lost 26 captive balloons and a further 23 aeroplanes, which were compelled to land as a result of fighting."

While the general policy of never attacking enemy aircraft beyond the German lines continued, there were not wanting signs both at the front and in the factories in Germany that neither money nor labour was being spared in preparing for an aerial "push" on a large scale.

More Types of German Aeroplanes

In addition to the new types of aircraft already mentioned, the Germans at this time commenced to specialise in speedy rapid single-seater chasers. Perhaps the most satisfactory of these new machines was that known as the Albatros D I, which was constructed at the Albatros works at Johannisthal, near Berlin. The Luft-Torpedo-Gesellschaft were building a chaser, which was known as the "Aerial Torpedo," and was not dissimilar in shape to the D I. Among the two-seater machines, the Roland Chaser D II proved the most serviceable, while the Halberstadt Chaser was already well developed. This machine was fitted with a 120 h.p. Argus six-cylinder, water-cooled engine.

The celebrated Gotha was beginning to be superseded by the faster Halberstadt, but was still rendering good service. A few general particulars of the former machine might not prove uninteresting at this juncture. The engines were each 260 h.p. six-cylinder Mercédès, mounted some fifteen feet apart, and completely enclosed within housings of three-ply and sheet aluminium. A honeycomb radiator was mounted in front of the engine on extensions of the bearers, and below the engine were located the fuel tanks.

The Halberstadt was given only a short trial on active service on the Western Front, after which it was withdrawn

exclusively for air-raiding purposes. Two further new German machines were distinctly novel. At the new large aerodrome at Coolkerke, experiments were being carried out with machines with double engines and propellers, with which the Germans declared that they would make surprising attacks on England. This new machine required experienced handling, and many losses occurred among the younger airmen when learning their management. About this time the Zeppelin works at Friedrichshaven were turned over exclusively for a new type of machine, which was claimed to be invisible from the ground. The fuselage of the new machine was serpentine in form, and from both sides it was possible to emit dense clouds of smoke which entirely concealed the machine.

Work on the Western Front

It would have been imagined in the light of this feverish activity and the cautious policy of their leaders, that the Germans would have made great headway at the battle front. However, this was not the case. After holding the mastery of the air for over three years, now they were obviously on the down grade and getting weaker every day. Something of the dispiriting influence which moved their ranks may be discovered in the following incident, reported in the *Times* of October 9th. Said the correspondent of that paper, in an account which was disgraceful for all time to German arms: "After capture, as you know, prisoners going back are often employed to escort or carry back their own wounded. I am sorry to say that there is no doubt that on one part of the line some of these men were killed by a German aeroplane, which flew down and used a machine gun on them. There can be no question that the airman knew precisely whom he was killing and the occupation on which they were engaged. And this airman was one of the very few Germans who came over the battlefield at all that stormy day. I have already told how magnificently some of our flying men did, and I have since heard from more than one quarter how our infantry watched our men overhead, battling with wind and rainstorms, making observations and keeping the air clear, while not a German was to be seen."

A Case of Mistaken Identity

On another occasion of the same nature it was clearly a case of mistaken identity, however. On September 2nd, a German airman, flying over a detachment of German prisoners working behind the lines, and thinking that they were British troops on the march, descended to a height of 300 feet, and dropped bombs, killing 43 of the prisoners and severely wounding 47. The following day an unknown number of German aeroplanes dropped on Calais some hundreds of objects resembling "Madelaines," covered with a substance resembling chocolate icing, which Allied chemists afterwards analysed and found to be poison. On September 3rd another lot of aeroplanes dropped bombs of a kind hitherto unknown, which did no damage worth mentioning.

Daily Activities of the German Aviators

Curiously enough, the daily activities of the German varied but little from those of the Allied aviators. Their period of greatest activity, again as with the Allied aviators, was during the closing months of the war. In three days in July—the 11th, 13th, and 14th—the military aviators brought down thirty-nine Allied aeroplanes and one captive balloon, two more being brought down by anti-aircraft fire. Lieutenant Ritter von Tutscheck won his sixteenth aerial victory, and naval air squadrons dropped bombs on the north Courland coast, on the batteries, barracks, and harbour works near Reval and Arensburg, and on the island of Oesel (north of the Gulf of Riga).

The naval aviators led off in the month of July; during the forenoon of July 14th naval seaplanes, near the Hoofden Bank, attacking a number of merchant vessels escorted by destroyers. It was definitely observed that two destroyers were struck by two direct bomb hits each. One lighter was also struck by a direct hit. (It should be mentioned that the Admiralty officially announced that none of the vessels referred to in the Berlin *communiqué* was hit or damaged.)

On the 23rd, and again on the 29th, the German airmen claimed unusually successful days. On the former day it was announced: "Our captive balloons, which are indispensable for artillery fighting, were along the whole front the object

of enemy long-range fire. East of Ypres they were also made the object of a combined attack by several aerial squadrons. Our battle airmen and anti-aircraft guns rendered these aerial attacks abortive. The captive balloons were undamaged. Eight enemy aeroplanes were shot down." And on the 29th that: "Aerial activity was extraordinarily lively, especially on the Flanders front. Thirty-five enemy airmen were shot down. Upper-Lieutenant Dossler, at the head of a pursuing squadron, destroyed a squadron of six enemy aeroplanes, and gained his twentieth aerial victory."

The Autumn Recovery

By the middle of September only in the air was the enemy anything but inferior to his past. On the 20th and the 21st the airmen took a prominent part in the fighting in Flanders. During that time thirty-nine Allied aircraft were accounted for and two captive balloons were shot down, to a loss of three German aeroplanes. Senior Lieutenant Scleich gained his twenty-first and twenty-second aerial victories. Lieutenant von Bulow shot down his twenty-first opponent, and Lieutenants Wusthof and Adam both shot down two Allied aviators; while on the 26th the Germans claimed seventeen Allied aeroplanes.

The German naval airmen, in the spring of 1918, if anything, were more active than their contemporaries over the trenches. Their work was essentially more of a punitive nature. They were the strategic, where the military were the tactical, unit of the enemy air force, and were responsible for all the aircraft raids on France and England. The Rhine towns had been heavily bombarded by the Allied airmen in January and February. According to a Berlin official telegram, February 11th, "thirty-one enemy air attacks on the German Homeland were carried out during January, fifteen of which were directed against Lorraine and Luxemburg industrial districts and fourteen on open towns. On Ludwigshafen and Frieburg three attacks each; on Treves, two attacks; on Friedrichshaven, Rastatt, Offenburg, Mannheim, Karlsruhe and Heidelberg, one attack each."

"Although the number of attacks," this report continued, "compared with the previous month was considerably increased,

owing to the favourable weather (*sic!*) the damage and casualties were fortunately smaller. Five persons were killed and nine wounded, while the material damage done was insignificant. There was no resultant interruption of work worth mentioning. The enemy lost four aeroplanes in the course of these attacks."

First Signs of Panic

Despite the official bravado, however, it was obvious to all that the Allied campaign of intensive bombing was making a greater, and deeper, impression than they would have cared to admit. Additional to their feverish spurt in aircraft construction, they again brought into action, after it had long been considered to have been abandoned, their Zeppelin fleet. Promiscuous and merciless bombing of neutral territory began to be carried out by panic-stricken German aviators almost daily. While over the firing lines, so affected was their *moral* that they dare only fly into action in large squadrons. A single machine never ventured out alone.

"Sometimes as many as fifteen fly together," Mr. Hamilton Fyfe reported on February 24. "Six is a common formation. Two of our photographic machines were attacked yesterday by half a dozen of the enemy's. They were annoyed at having to suspend their picture-taking on such a good day. However, they took to their guns with so vigorous an indignation that in a very short while they had knocked out two of their attackers. The rest then flew away and the photographers went on photographing.

"Once a single British machine was set upon by six Germans. One of them was brought down immediately; then the leader challenged the Englishman to single combat. The latter shot him. Now the sportsmanlike course for the others would have been to take their turns one by one. Instead of that they all dived at the Englishman at once. He saw that he had only one chance of escape. This was to fly very low. He dropped and almost skimmed the tops of the trees and the roofs of the buildings. So he got home safe." Somewhat of a different story to those of the German giants of the early days of the war.

German Triumph and Defeat

War on Neutrals

The altogether unwarranted bombing of neutral territory by German airmen about this time may be ascribed to three causes. It may have been intended as a clumsy threat to the friendly Power; to a defective engine, or to childish errors in navigation on the part of the German observers, so that the crews of their aircraft inevitably lost their way. The latter was the least probable reason.

Not only Holland was affected in this respect, but also Denmark and Switzerland. In a period of nine months no less than nine German bombing aircraft came down, or were shot down on Dutch soil. Somehow, too, it seemed as though fate—just retribution—had set its face against the German aviators in their barbarous practice of violating Dutch territory. In the early morning of December 9, 1917, two Gothas, returning from a raid on England, collided in mid-air while flying over Gentbrugge. Both the machines were destroyed and their crews all killed.

The violations commenced on October 31, 1917, when a German aeroplane landed a short distance from Holten. The occupants, a naval officer and a N.C.O., who had previously set fire to their machine, were arrested by the Dutch sentries and taken into Deventer, where they were imprisoned. Again on December 5 two occupants of a German seaplane, which fell into the North Sea and was adrift for twenty-four hours, were taken into Flushing.

So incensed were the Dutch authorities with these constant violations that, the second week in December, the Government, through its Minister in Berlin, made a strong protest to the German Government—the visit of a Zeppelin, which, coming in from the west without any signs of distress, remained cruising over the northern provinces of Holland for some hours, being fired at by the military at Harlingen and Donderen, bringing the matter to a head.

The Germans did not reply to this note for some time, and then it was only after a second protest had been received in Berlin that it was officially announced in Holland that the German Government had expressed to the Dutch Government its deep regret at the falling of a bomb—the occasion of the

second protest—from a German aeroplane in Dutch territorial waters on the occasion of the arrival of a British convoy on February 27, 1918. The bomb, it was ingeniously explained, broke loose from the aeroplane when the airman observed that he was over Dutch territory and turned quickly in order to change his course.

For some few months after this the German aviators wisely refrained from flying over Holland. But not for long. Within three days—April 11 to the 13—a reconnaissance aeroplane, a battleplane, and a large German balloon all found their way into the hands of the Dutch. The battleplane came down near Axel, Zeeland, and both its occupants promptly were interned. Near Barneveld, in the province of Gelderland, descended a large German balloon, numbered 57 and marked "Marine Corps," while it was reported from Holland on April 12 that a German aeroplane had crossed the frontier of the province of Zeeland and landed its occupants, who were interned.

During the next five months there were yet another five cases of deliberate violation, which seemed to increase in aggressiveness as the war went on; Germany was driven from the skies, and her aviators grew more panic-stricken. Four German airmen who came down in the Weilingen (the mouth of the Scheldt) were promptly interned, as also the crew of a biplane which landed at Uithnuizen three days later. Two other German naval airmen, the same day, had the narrowest shave from drowning. Fortunately for them, however, they were discovered by a Dutch lugger six miles north-east of the Haaks lightship on a seaplane in a sinking condition. The pilot was careful to sink his machine before being taken off. In August no less than thirty-eight German aircraft violated Dutch territory.

On August 9 a German biplane, flying over Sas van Gent in the direction of Flanders, was fired at by the Dutch frontier guards, and the same day another machine, passing over Eindhoven, was fired at by the military.

The Worst Outrage

The worst aerial outrage on Holland occurred rather late in August. On the 17th the Dutch guards at Beerta fired on and

brought down a German machine with three passengers, while another was forced to land at Blyham, where it was set on fire by the occupants, while two further machines were severely damaged by the Dutch fire, but succeeded in getting across the frontier into Belgium.

It was thought then that matters had reached a climax. But the following day it was reported from Amsterdam that at about 8 A.M. about thirty German aeroplanes passed over Aardenburg, in Zeeland, going in a westerly direction, apparently, from later information, with England as their objective. They were fired on by the Dutch guards without result. Several machines of an unknown nationality passed over the islands of Schouwen and Goedereede and dropped bombs, but fortunately no one was injured and the material damage was slight.

Four German Aircraft in One Day

On September 25 the Dutch bagged no less than four German aeroplanes in one day. First, a Dutch torpedo-boat found a large German twin-engine seaplane down off the Zeeland coast and ordered its occupants aboard his craft. Barely had they done so, however, when five German seaplanes came up from Zeebrugge. One of the latter came down and endeavoured to tow away the damaged seaplane, and it required a volley from a party of marines on the torpedo-boat before they would clear off. The Dutch eventually towed the big seaplane, and also the smaller one which had attempted its rescue, into Flushing.

In another instance it was a German machine returning from a raid on England which was captured. Bearing the number G.O.C.4, No. 692/16, this machine was forced by engine trouble to descend near Sas van Gent. One of the occupants was found to be wounded, and on landing his two companions immediately abandoned him and attempted to escape into Germany across the frontier. They were caught, however, and were afterwards interned. Six bombs were found aboard the machine, together with maps of southern England, London, Zeeland and Flanders.

It was noticeable always throughout the war, whenever the

Germans were contemplating an immediate return to Zeppelin warfare their propagandists were engaged busily in spreading false rumours concerning the unusual properties of lighter-than-air craft last experimented with in the homeland. The 1918 campaign was no exception to the rule. Previous to this campaign, which from the enemy's point of view proved the most disastrous of the whole war, it was allowed to be known—in the usual obliging fashion of the Intelligence Section of Main Headquarters—that at Geneva experiments were being carried out with a new type of Zeppelin which was fitted with silenced engines. Further, that this wonderful new ship had made its maiden flight over the Italian Front dropping propaganda leaflets among the troops of our Allies. The latter proved incorrect, as the former report.

While it must be admitted that the revival of Zeppelin warfare came as a complete surprise to the Allies, it profited the enemy but little. The Silent Raid was the only outcome of this carefully prepared surprise, and the Silent Raid surprised no one more than the Germans themselves, and that in the most unpleasant fashion, as was told in the previous volume. To ease the smart, as was their customary habit, the military authorities, to still public anxiety on the subject of the air services, immediately issued a highly flattering, and erroneous, table of comparisons of German and Allied air fighting in three years of war.

As though to crown their ignominious defeat with a display of the most childish humour, the *Berliner Tageblatt* chose this particular moment to publish the following bombastic collation with the only grace that, "exact details up to the end of February, 1915, and for July, 1917, are not yet forthcoming, so that the figures for these periods are not absolutely trustworthy":

AEROPLANES DESTROYED

	German.	Allied.
1914	—	9
1915	91	131
1916	221	784
1917, to end of July	370	1,374

German Triumph and Defeat

From August 1, 1914, to July 31, 1915, the *Tageblatt* goes on to claim, 72 enemy aeroplanes were shot down, of which 39 fell into German hands; from August 1, 1915, to July 31, 1916, 455 enemy aeroplanes were shot down, of which 267 fell into German hands; from August 1, 1916, to July 31, 1917, "about" 1,771 enemy aeroplanes were shot down, of which 776 fell into German hands. In 1915 two enemy captive balloons, as far as is known, were shot down; in 1916, 42; in 1917, to August 1, 142. Three enemy airships were also shot down. Total aircraft shot down from August 1, 1914, to August 1, 1917, about 2,298 enemy and 682 German aeroplanes, 186 enemy captive balloons, and three airships.

CHAPTER VII

THE ROYAL AIR FORCE IN BEING

King's Message to the New Force—The Air Council—The R.A.F. behind the Lines—The Work of the A.D.—The Romance of the A.R.S.—Assembling—The Daily Round—A Day's Work in the Air—Tails Up!—Early Months—The "Balloonatics"—Varied Activities of One Week—Bombing Activity—June Aerial Ventures—Photographic Incidents—Bombing Campaign—The Year in the Air (1917-18)—Some Incidents—Deeds of the Rankers—Aerial Rescues from No Man's Land.

On April 1, 1918, the Royal Air Force, with the fusion of the Royal Naval Air Service and the Royal Flying Corps, was established as a separate Service, the occasion being taken by the King to send the following telegram to Lord Rothermere, then Air Minister:

> "To-day the Royal Air Force, of which you are the Minister in charge, comes into existence as a third arm of the defences of the Empire. As General-in-Chief I congratulate you on its birth, and I trust that it may enjoy a vigorous and successful life.
>
> "I am confident that the union of the Royal Naval Air Service and the Royal Flying Corps will preserve and foster that esprit de corps which these two separate forces have created by their splendid deeds."

To which encouraging message the Minister for Air replied:

> "Lord Rothermere, with his humble duty to Your Majesty, begs leave on behalf of the Royal Air Force to convey an expression of their heartfelt appreciation of the gracious message addressed to them by their General-in-Chief. Lord Rothermere is confident that the assurance of Your Majesty's interest and confidence will assist every officer and man in the Royal Air Force in the task of con-

tinuing the great traditions of the Royal Naval Air Service and the Royal Flying Corps—traditions which, as Your Majesty has personally seen, have never been more gloriously maintained than in the struggle now proceeding."

On the signing of the Armistice on November 11, 1918, the establishment of the Royal Air Force was as follows: The total of officers was 30,000, of whom 10,000 were pilots and 20,000 observers, on the active service list. Other ranks numbered 264,000, of whom 21,000 were flying cadets in training for commission. There were 21,000 aeroplanes on charge, 1,300 seaplanes, and 103 airships; 25,000 aeroplanes and seaplanes also were on order, together with 55,000 engines. The total number of squadrons amounted to over 300—consisting of about 200 service squadrons, 50 training squadrons, and 60 training depot stations. The membership of the W.R.A.F. stood at the close of hostilities at 23,000.

It was on January 3, 1918, that the Air Council first came into being. The previous day it had been announced by an Order in Council that it was to be constituted as follows:

Lord Rothermere, *Secretary of State and President of the Council.*

Major-General Sir H. Trenchard, K.C.B., D.S.O., *Chief of the Air Staff.*

Rear-Admiral Mark Kerr, C.B., R.N., *Deputy Chief of the Air Staff.*

Commodore Godfrey Paine, C.B., M.V.O., R.N., *Master-General of Personnel.*

Major-General W. S. Brancker, *Comptroller-General of Equipment.*

Sir William Weir, *Director-General of Aircraft Production in the Ministry of Munitions.*

Sir John Hunter, K.B.E., *Administrator of Works and Buildings.*

Major J. L. Baird, C.M.G., D.S.O., M.P., *Parliamentary Under-Secretary of State.*

Lieutenant-General Sir David Henderson, K.C.B., D.S.O., *Additional Member of Council and Vice-President.*

Mr. W. A. Robinson, C.B., was appointed to act temporarily

as Secretary to the Council, and Mr. H. W. McAnally to act as Assistant Secretary.

Sir John Hunter, K.B.E., continued to perform his duties in the Ministry of Munitions, in addition to acting as Administrator of Works and Buildings in the Air Ministry.

By the same Order in Council it was provided that the President of the Air Council could appoint one of the two additional members to be Vice-President; and that in paragraph 2 of the Order in Council of December 21, 1917, for the words, "the Controller-General of Equipment and the Inspector-General of the Air Force" there should be substituted the words "and the Controller-General of Equipment."

This was followed in due course by the following announcement which appeared in the *London Gazette* of March 15:

"GEORGE THE FIFTH, by the Grace of God of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, Defender of the Faith, To all to whom these Presents shall come, Greeting!

"Whereas by the Air Force (Constitution) Act, 1917, it is enacted that it shall be lawful for Us to raise and maintain a Force, to be called the Air Force, consisting of such numbers of officers, warrant officers, non-commissioned officers and men, as may from time to time be provided by Parliament:

"Now know ye that it is Our Will and Pleasure that the Air Force to be established pursuant to the said Act shall be styled the 'Royal Air Force.'"

Constitution of the R.A.F.

The constitution of the new Royal Air Force was too technical and of too intimate a nature to bear repetition in these pages. The rank of officers transferred to the R.A.F. in comparison with that of the corresponding rank in the Navy and Army, however, may prove of interest. In this respect the new Service, in a brief summary, was graded as follows:

R.N.A.S.—Wing Commander, Wing Observer, Commander R.N.V.R., Fleet Paymaster, Naval Instructor (15 years' seniority) . .	*Lieut.-Colonel.*
R.F.C.—Wing Commander (Lieut.-Colonel), Depot Commander (Lieut.-Colonel).	

R.N.A.S.—Squadron Commander, Squadron Observer, Lieut.-Commander R.N.V.R., Staff Paymaster, Naval Instructor (8 years' seniority) R.F.C.—Squadron Commander (Major), Park Commander (Major).	*Major.*
R.N.A.S.—Flight Commander, Flight Observer, Lieut. R.N.V.R., Paymaster, Assistant Paymaster (4 years' seniority), Naval Instructor . R.F.C.—Flight Commander, Equipment Officer (1st) Wing Adjutant.	*Captain.*
R.N.A.S.—Flight Lieut., Observer Lieut., Flight Sub-Lieut., Observer Sub-Lieut., W.O. 1st class. R.F.C.—Flying Officer (2nd Lieut. or Lieutenant), Flying Officer Observer (2nd Lieut. or Lieutenant), Equipment Officer (2nd Lieut.), Acting Adjutant	*Lieutenant.*
R.N.A.S.—W.O. 2nd Class . . . . R.F.C.—Equipment Officer (3rd) (2nd Lieut.) .	*2nd Lieutenant.*
R.N.A.S.—Probationary Flight Officer, Probationary Observer Officer . . . . . R.F.C.—2nd Lieuts. on probation . . .	*Probationers.*

The following additional Army Order was issued on March 29:

"1. The Air Council has, as already notified, taken over the administration of all technical air material, and all movements and postings of individuals of the Air Service.

"2. It has now been decided that the Royal Air Force is to be brought into being as a unified force as from April 1, 1918, from which date its administration will be vested in the Air Council.

"3. From that date the procedure as between the Army Council and the Air Council, and between military commanders and Royal Air Force commanders as regards the allocation and command of bodies of the Royal Air Force, and as regards correspondence, will be as follows:

"(i) The Army Council will indicate to the Air Council the number of squadrons of the various classes required for all military commands at home and abroad; where necessary they will inform the Air Council of any increases or decreases which they consider should be made.

"(ii) The Air Council will organise and equip these forces and hand them over as complete organisations to the military

commanders. They will maintain them in personnel and equipment. Should the Air Council not be in a position to supply the complete requirements, to effect increases demanded, or to maintain air forces already provided, it will be for the Army Council to decide whether the deficiency can be met at the expense of contingents of the Royal Air Force operating under military commanders in other theatres.

"(iii) Serious deficiencies in personnel or equipment of Royal Air Force contingents, which are such as to affect materially the efficiency of the military force concerned, will be brought to the notice of the military commander by the Royal Air Force commander and communicated by the former to the Army Council.

"(iv) The military commander, who has under his orders a contingent of the Royal Air Force, will have the power to remove the commander of that contingent should he consider such action necessary, and may appoint temporarily a Royal Air Force officer to command from those available locally. The permanent replacement of the officer will be carried out by the Air Council after consultation with the Army Council.

"(v) Removal or transfer of subordinate Royal Air Force officers belonging to contingents under military commands will normally be carried out, without consultation with the Army Council, by the Air Council, who will issue their instructions direct to the local Royal Air Force commander.

"Should a military commander be dissatisfied with a subordinate Royal Air Force officer acting under his orders, he will have power to direct the local Royal Air Force commander to suspend the subordinate officer of the Royal Air Force pending reference to the Air Council. In such cases the Air Council will consult the Army Council as to the action to be taken.

"(vi) Important alterations in the establishment or equipment of Air Force units allotted to military commanders, such as will affect the mobility or efficiency of the military force as a whole, will not be carried out without the concurrence of the Army Council.

"(vii) Alterations of approved establishments, suggested by the Royal Air Force commander for the improvement of the contingent under his command, will be submitted through the

military commander concerned, and by the latter to the Army Council.

"(viii) Recommendations for improved methods of co-operation or training with other arms will be submitted by military commanders to the Army Council, who will forward them with their recommendations to the Air Council.

"(ix) In general, communications on air subjects from military commanders, whether initiated by or forwarded at the request of Royal Air Force Officers or not, will continue to be addressed to the Army Council. The Army Council will inform the Air Council of the contents of these communications as may be necessary.

"(x) Reports and recommendations dealing with the technical training or equipment of Royal Air Force units will be submitted by Royal Air Force commanders direct to the Air Council, and instructions on these subjects will be issued by the Air Council direct to the Royal Air Force commander concerned.

"(xi) Reports on air operations of the Royal Air Force contingents allotted to military commanders will be forwarded by the Royal Air Force commander simultaneously to the military commander concerned and to the Chief of the Air Staff, Air Council."

Resignation of Lord Rothermere

Unfortunately, the new Air Force had been in existence but a few days when misunderstandings began at the Air Ministry. Sir Hugh Trenchard tendered his resignation as Chief of the Air Staff to the Air Minister, and it was promptly accepted.

On April 13 it was announced by the Air Ministry that His Majesty the King had been pleased to appoint Major-General F. H. Sykes, C.M.G., to be Chief of the Air Staff, Royal Air Force. Brigadier-General Guy Livingston, C.M.G., was appointed Air Secretary to the Secretary of State, combining the duties with those of his appointment as Deputy Master-General of Personnel in the Air Ministry.

Even then the new force had not reached a stable foundation. Within a month Lord Rothermere had followed in the

footsteps of General Trenchard, and on April 27 it was announced that the King had approved the appointment of Sir William Weir to be Secretary of State. The same day Sir William—afterwards Lord—Weir was sworn a Member of His Majesty's Most Honourable Privy Council at Buckingham Palace. While previous to the Council Lord Robert Cecil, M.P., was received in audience by the King, and on behalf of Lord Rothermere surrendered the seals of Secretary of State of the Royal Air Force and President of the Air Council.

The incident, which caused considerable public apprehension at the time, concluded with the following interesting correspondence between the retiring Air Minister and the Premier.

On April 25 Lord Rothermere wrote as follows:

"My dear Prime Minister,—I desire to relinquish my office as Secretary of State of the Air Force at the earliest possible date.

"The Royal Air Force is now one of the three established fighting services of the Crown. The fusion of the Royal Naval Air Service and the Royal Flying Corps has been successfully accomplished.

"At times I have thought I would not be able to accompany the new force so far. My second tragic loss in the war ten weeks since caused, and causes, me great distress of mind and body. Every day the burden of work and responsibility seemed crushing, and I was suffering much from ill-health and insomnia.

"I felt, as I told you, my urgent primary duty to the Government and the nation required me to remain, if at all physically possible, until the date of the fusion and such time after as would suffice to establish the success of the amalgamation. My departure before might have gravely deranged what is now one of the nation's arms of war, and have jeopardised the success of the whole scheme.

"Lately I thought I might be able to remain, but a recurrence of bronchial trouble, with insomnia, effectually prevents this.

"I have entered into these particulars because I wish you to know the difficulties under which I have been working.

"I cannot close this letter without an expression of my great regard and respect."

To which Mr. Lloyd George replied the same day as follows:

"10, Downing Street, S.W.1.
"*April* 25, 1918.

"My dear Rothermere,—I have received your letter tendering your resignation as Secretary of State for the Air Force with the deepest regret. Your work there has been of inestimable service to the nation, and time will bring with it a full recognition of your achievement. It is no small thing to have taken over the conduct of an entirely new arm of the Service in the middle of a great war, to have extricated it from the difficulties which surrounded it, co-ordinated the two Services which made it up, and bestowed on its administration an initiative which has given the new force a real supremacy at the front. And all this has been done in such a brief period of time.

"It is the more to be lamented that, having set the Ministry on its legs, you cannot remain to enjoy the fruition of your own brilliant work. But I feel, on reading your letter, that I cannot press you to stay, much as the Government must suffer from your retirement.

"Your sacrifices to the national cause have been so heavy, and the strain imposed on you so cruel, that it would be impossible to deny you the right to some repose. Sympathy in these matters is generally best given by silence, but I am sure that you know, without my telling, how much I sympathise with you in your losses and in the way in which you have continued your public duties in spite of everything.

"No Minister ever had greater difficulties to contend with than you had in effecting the fusion of the two Services, and the Air Force has every right to be proud of its First Secretary of State.

"I am authorised by my colleagues to state that they share fully the views I have expressed in this letter.—Yours very faithfully, D. Lloyd George."

What the Air Force Saved Great Britain

While these unfortunate incidents were taking place at home, it is doubly of interest to be able to record that in the field the Royal Air Force was making splendid progress.

Though, on the one hand, the output of expensive aircraft was doubled, trebled, and quadrupled in the space of a few short months, on the other the saving effected by the nation by her gallant aviators was enormous.

Mr. Kellaway, the Parliamentary Secretary of the Ministry of Munitions, announced that for the first two months of the year, compared with the first two months of 1917, the increase of aircraft, in aeroplanes was 223 per cent., and in aero-engines 245 per cent.; and that the average weekly production of aeroplanes for the year equalled the average production for two months in 1915. This enabled the R.A.F. to save Great Britain many thousands of lives and millions of pounds in the closing stages of the war, inasmuch as its activities lessened by an unreckoned but certainly considerable number of days the period of actual battle.

The German armies began to crumble as the demoralisation of the soldiers spread. This weakening of the *moral* was largely caused by the offensive policy of the British Air Force. Nothing except starvation was more likely to undermine the spirit of troops in the field than the continual worrying of bombs and machine-gun fire far behind the front lines. If in a forced retreat the troops were continually being attacked from the air, and seeing their numbers thinned hour by hour as they left their comrades' bodies unburied by the side of the road; if they had continually to break formation, and to scatter into the surrounding fields, their nervousness was certain to increase and they inevitably got more and more out of hand as their determination was worn away.

If they knew that they would be attacked in their billets ten miles away from the front, and would perhaps suffer as many casualties there as they had in the front line trenches, they would soon be entirely unfit to offer any considerable resistance to the onslaught of an enemy whose *moral* had not been similarly affected.

For the beaten side there was no rest—they were never able to leave the battle zone. Night brought them no peace. The crash of exploding bombs, the whistle of machine-gun bullets, and the throbbing of aeroplane engines brought an incessant interruption to their rest. Daylight and its new

HELP FROM THE AIR

A remarkable development of the work of the "contact patrol" planes was the conveying of ammunition and food to the front line trenches and isolated posts. The package was dropped from the plane on a parachute as shown in this drawing.

terrors of the air found them tired-eyed and strained, with no strength of mind to meet a new series of unnerving attacks.

Meanwhile they knew that their communications were in a state of chaos. Supplies were late and of a limited quantity. Small-arm ammunition and hand grenades ran out, and there were no new stocks from which the pouches and bags could be replenished. Torn-up railway lines and bomb-swept roads alike interfered with the even flow of communications.

So day followed day. The weary men never knew when the hum of a machine might suddenly sound in some cloud overhead, and through the mist drop like a plummet; a swift engine of death which would hurl down its cargo of destruction, and with a roar of triumph swoop up into the clouds again out of sight.

Each of those days of horror for them was a day of relief for the attacking force, which had to meet a weakened foe. The final collapse came many days before it was scheduled. Far fewer casualties were caused to the victors than was expected, and they had been averted by the skill and unceasing activity of the British squadrons of the skies.

Thus the determined offensive of the Royal Air Force helped to bring about the German disaster of October and November —a disaster which would have been infinitely less complete if Great Britain had not held the upper hand in the air.

Meanwhile, in this great saving effected, it is only fair to mention the wonderful work carried out by the A.R.S., or Aeroplane Repair Section, and of the Aircraft Supply Depots (A.S.D.).

The R.A.F. Behind the Lines

How few of the public knew of the wonderful organisation it was necessary to maintain behind the firing lines to provide the actual flying units which were necessary, in their turn, to maintain in the air the vast collection of machines on the strength of the R.A.F. at the beginning of November, 1918.

This organisation may be conveniently divided into four portions—in addition, of course, to the supply of personnel—dealing respectively with complete machines and the salvage and rebuilding of damaged ones; the supply of all spares,

stores and equipment; the construction and preparation of aerodromes, and, lastly, the provision and repair of mechanical transport.

The machines themselves of all types were supplied by the Aircraft Supply Depots. At the conclusion of hostilities there were three of these : No. 1 A.S.D., at Marquise, which supplied all units in the northern sector; No. 2, which served the southern sector; and No. 3, which provided machines for the Independent Force. Incidentally every machine received in France passed through No. 1 A.S.D., as it was conveniently situated on the coast, and so served as a reception base for the machines as they were flown from England.

The planes from the A.S.D.'s were passed to mobile issue sections located nearer the lines, and in turn supplied by them to squadrons as required.

Working in connection with each A.S.D. were several salvage sections, whose organisation we will endeavour to describe later. These also were situated close up to the squadrons, and were responsible for collecting damaged machines; where necessary, reducing them to scrap, or in most cases sending them down to the Aeroplane Repair Section of the A.S.D.

Originally machines as well as spares had been supplied by the aircraft depots, but the rapid growth of the R.A.F. in France rendered it necessary to create separate units for the purpose.

The Work of the A.D.

Even with this subdivision of work, the A.D.'s—of which there were also three serving the same areas and unit as the A.S.D.'s—were very large units, and the variety and quantity of stores and equipment they had to carry was immense.

Every part of every type of machine in use had to be stocked. All the numerous instruments and " gadgets " which had multiplied so rapidly, guns, bomb racks, sights, etc., wireless and photographic apparatus, all spares for transports, propellers of every type, engine parts—all these had to be instantly available for the needs of the squadrons. The spares were

distributed through aircraft parks—which were the advanced mobile issue sections of the A.D.'s.

Complete engines, as well as spares, were issued by the A.D.'s, and to keep them overhauled and in repair another large establishment was required—the engine repair shops, employing a staff of nearly 5,000. These shops carried out the repairs for all three A.D.'s. That is to say, they were responsible for the repair of the engines of the whole R.A.F. in France—a work of vast magnitude.

Though each A.D. had a small section for minor repairs and the issue of mechanical transport, it was found necessary to establish a base depot for the reception from England, serious repairs, and periodic complete overhauls of all R.A.F. transport.

This, again, was a large undertaking and covered many acres of ground, for the transport of an air force in the field was large and very varied in type.

The construction of aerodromes was the work of aerodrome service units, of which tent detachments for the erection of hangars, etc., were a part. Several Canadian Forestry Companies were attached to the A.S.'s during the war and rendered valuable service.

This, of course, is only a brief outline of the extensive R.A.F. organisation behind the line, but it is hardly necessary to emphasise the fact that its duties had been just as essential in the winning of the British aerial supremacy as those of the actual fighting units.

The Romance of the A.R.S.

In addition to the invaluable services rendered by these two sections must be recorded that of another already mentioned —the A.R.S.

A.R.S. stood for Aeroplane Repair Section. Attached to almost every Royal Air Force station was a section devoted to the repair of minor damage to aeroplanes. It had its separate shed, its separate carpenters' shop, and various other shops needed for the making and repairing of the smaller parts of a machine. Specially trained parties of fitters and riggers and other air mechanics spent all their time on this work under a

technical officer, who was also a specialist at this kind of work.

The layman might ask, "Were crashes, then, so numerous that a special repair section was necessary at every R.A.F. station?" The answer is that serious crashes were not common; in relation to the amount of flying done, they were surprisingly rare. But minor damage was common.

In its own element an aeroplane possessed marvellous qualities of strength and endurance. But on the unyielding earth it was very susceptible to damage. The most difficult feat for flying pupils was a good landing. The transition (necessarily at express train speed) from flight to motoring over solid earth demanded nice handling, and a slight error of judgment would cause a mishap which, while it did the young pilot no harm, inevitably sent the machine into the A.R.S.

There the damaged parts were removed. What could be repaired was sent to the appropriate workshop, and new parts were obtained to replace those irretrievably demaged. The machine was then built up again and carefully inspected by experts before it was allowed to fly.

Moreover, when manufacturers sent new machines to aerodromes, they usually went by rail, and, of course, their wings were sent separately, as a fully-rigged machine would not go into a railway truck. On arrival they were brought from the station to the aerodrome by the mechanical transport, and handed over to the A.R.S. to be rigged. The technical officer in charge saw the "fuselage" or body of the machine arrive, looking for all the world like a giant chrysalis, a thing which seemed dead, but was capable of blossoming into life. A party was told off to rig it. The wings and tail were fastened on with specially strong wires. The controls were connected and adjusted, and finally the engine was fitted. Then the doors of the shed were opened, and the beautiful butterfly emerged. The engine was tested, the pilot took his seat, and the wonderful creature soared away into the air.

The work of the A.R.S. was full of incident and excitement. When crashes were numerous and the pilots were clamouring for machines, the A.R.S. parties had to work all

night, and great was the anxiety to see if all would go well and the machine be ready to fly in the morning. In particular the work of an A.R.S. officer was full of interest. He was always studying the wonderful flying machines and discussing with pilots the best way to "rig" them. Some pilots liked the wires very tight, and others preferred them with more play. The theory of flight was a fascinating study, and the pilots and the A.R.S. officer discussed it together and put their theories to the test. And when all the pilots in the station were in the air, and content, no man was prouder than the officer of the A.R.S.

The Daily Round

That is one side of the picture. The other is of the aviator in action—the one test of the fruit of all this most careful thought and preparation. It is a picture at once thrilling and efficient to a commonplace degree, which, the better to understand, it will be necessary for the reader to take himself back to those black days of trial and suspense of March, 1918.

A Royal Air Force squadron in France, so far as its work is concerned, is an almost completely self-contained unit.

Apart from the actual flying, which constitutes the *raison d'être,* there is very much work, more or less directly connected with flying, to be done with regularity to maintain the squadron's efficiency.

Take, for example, a corps reconnaissance squadron, whose duties comprise counter-battery work for the artillery, photography and occasional odd jobs such as trench-strafing and bombing.

In the first place, practically all repairs to machine and motor vehicles that can be undertaken on the station must be carried out immediately and continuously, so that no part of its equipment is for long unserviceable. This is the maxim underlying all the work of the squadron—all machines and transport must be kept serviceable always and ready for immediate action. If a machine is damaged, either in combat or as the result of a bad landing, it must be repaired at once; if a vehicle breaks down it must be rendered effective without any delay; nothing

must remain out of action. Sufficient stores and spares are carried to make these repairs possible, and it is the duty of the equipment officer to see that this stock is maintained. Excellent and well-equipped mobile workshops are provided for carrying out the work.

Aeroplane engines require constant and regular inspection and overhaul, and sometimes replacement. M.T. vehicles, too, must be kept clean and well greased and oiled. The armament officer is responsible for the maintenance and repair of the guns on each machine, and for the effective working and tuning of the gear which enables the forward guns to fire regularly between the blades of the propeller. Every gun must be thoroughly cleaned after each patrol, and any trouble which the pilot or observer reports must be investigated and rectified.

Each battery or group of batteries with which the squadron works is kept supplied with a wireless instrument and operator, and their maintenance necessitates a daily visit of inspection by the wireless officer. He must also see that the instruments carried on the machine are kept in a state of perfect efficiency.

In the same way the cameras used for photographic reconnaissance will receive the regular and scrupulous attention of the photographic officer, whose staff is kept hard at work developing and printing the hundreds of negatives brought back by the observers.

In addition to this work of the specialists, the ordinary routine duties of a unit in camp have to be carried out. Huts, hangars and dug-outs have to be constructed, maintained and repaired after the visits of the German bombers, for example; the sanitary arrangements of the camp kept in perfect order. Rations and stores, and in some cases water, must be collected; the mail taken to and fetched from railhead; dispatches, returns and other information supplied punctually to Headquarters, and the ordinary routine records and clerical work of the squadron kept well in hand by the orderly room.

The feature of all this R.A.F. life in the battle zone is that nothing can ever be allowed to "stand over"; everything comes into the "urgent" category. All night work is, of course, a common thing in day-flying as well as night-flying squadrons; and 3 A.M. is no uncommon hour for turning out of bed. There

is no time wasted, and withal the level of animal spirits is extraordinarily high, and those in command are too wise to allow recreation and sport to be crowded out. There are always games and laughter.

R.A.F. Administrative Officers

Behind this splendid organisation, too, there is a host of exclusive and technical sidelines and of technical, but highly necessary, experts.

The Royal Air Force is not by any means entirely composed of pilots, observers, and air mechanics.

It is a complex organisation, and many individuals, officers and men and also women, must work very hard upon the ground if the work in the air is to be carried on efficiently.

In the first place, the whole personnel of the force naturally needs supervision and control. Discipline and smooth-working routine must be maintained; pay and allowances must be drawn for each individual. Men must be fed and provided with clothes and bedding. These things do not just happen.

In the second place, aeroplanes and their engines need unremitting care and attention. An aero engine calls for quite as many minor repairs as the engine of a motor-car, for it is submitted to greater strains. The aeroplanes themselves sometimes burst the tyres of their wheels, get rents in the fabric which covers their wings, and sometimes even indulge in crashes which make it necessary to replace different wood or metal parts.

"A.," "Q." and "S."

To provide all these needs is the task of what are called Administrative Officers. They are divided into three classes—"A," "Q" and "S." The first class corresponds to the adjutants of the army. They act as staff officers to the commanders of stations or wings, administer discipline, deal with pay and promotion, correspondence, records, postings and transfers, and all other questions which affect the individuals who compose the force.

"Q" stands for Quartermaster, and this officer's duties are clearly defined. All that concerns the board, lodging and feed-

ing of the rank and file comes under him. In addition, he is responsible for the rifles and ammunition, while he fills up his spare time by procuring and storing the petrol needed for the aeroplanes and the mechanical transport.

"S" stands for Stores, and the duty of the administrative "S" officers is to procure and distribute all the accessories needed to keep the aeroplanes, engines, mechanical transport, etc., in a serviceable condition. The stores officers are not responsible for carrying out repairs. That is performed by the air mechanics, working under the direction of technical officers. The task of complying promptly with the demands of the technical officers keeps the stores officers very busy indeed.

There are one or two stores officers on every aerodrome. They send in their indents to the Stores Distributing Park of the district, where a whole staff of stores officers is engaged in collecting spare parts of different types from various depots and dispatching them to the aerodromes in accordance with the indents. Each depot deals in one class of spare parts. It procures supplies of these parts from the manufacturers and dispatches them to the various parks. This work must be carried out with minute care and exactness, or confusion and loss will speedily result.

Obviously there must be many officers in the R.A.F. whose work never takes them into the air; and without administrative officers behind them the pilots would be quite unable to carry on their business.

The end more than justifies the means. As a reflection of this unusual effort—and at times it was almost superhuman—here is the record of a single day's work of the British aviators on the Western Front in March, 1918.

The official *communiqué* of the work carried out by the Royal Air Force on that day contains figures that are certainly striking, though not more so than those of a good many other days in the short, brilliant history of British airmanship.

Thirty-two enemy machines were destroyed in combat and ten were driven down out of control, besides which two hostile balloons were shot down in flames. In other words, forty-two enemy machines were accounted for with a loss to the R.A.F. of eight machines.

Many successful bombing raids were carried out on important railway junctions, whilst throughout the day the contact patrols and low strafing machines were constantly busy. For one day's bag—and the weather was by no means brilliant—these figures reflect the greatest possible credit on the British flying services, and leave no doubt as to which side possessed the aerial superiority at this time.

A Day's Work in the Air

While again these figures convey a representative idea of the results achieved, in their turn they are not half so convincing as a repetition, one after the other, of the more striking incidents which went to make up this glorious day's work. Haphazard as they are, selected from the various official reports, the chance choice may lead the reader to believe—incorrectly enough—that it is a record day which boasts such unusual happenings.

An Australian pilot, for instance, made a very successful single-handed attack upon a German aerodrome. Diving down to 200 feet, he dropped three bombs upon a group of German machines standing outside the hangars, totally destroying two of them. He then dropped a fourth bomb upon a hangar, obtaining another direct hit. Next, he opened fire with his machine-gun upon the German mechanics, hitting many and scattering the remainder in all directions before he climbed and turned for home.

A British scout pilot, on the night of that day, was searching for a German bombing plane which he believed to be in the vicinity. After circling round for some time he suddenly saw the German bomber caught in the beams of a British searchlight. Immediately all the other searchlights in the vicinity fastened on the raider, who vainly dived and wriggled to escape the silver tentacles. Swiftly diving from his greater height, the British pilot opened fire, and after a brief struggle the German raider went down in a mass of flame.

Before returning to his 'drome the British pilot engaged another German bombing machine which, after a few bursts from his machine-gun, went down in a steep dive. Owing to the darkness of the night, however, it was not possible for the British pilot to observe the fate of the second victim.

Down in Flames

The following—also that day—illustrates a very common type of incident, in which the British pilot invariably put up an excellent fight, but was unable positively to record a victory.

A British two-seater machine on patrol encountered a German Fokker biplane. The British pilot manœuvred his machine so that the observer was able to bring his gun to bear with a burst of eighty rounds. The German was clearly hit, but he dived so swiftly eastwards as to be lost to sight from the British machine, which, being on patrol, could not follow it up.

In this particular case, however, the British flying men were not to be denied the satisfaction of knowing the ultimate result of their effort, for, later on, reports came in from the infantry outposts stating that the German biplane had crashed in the German lines, and had instantly burst into flames. Precise calculations as to time, direction, and place proved beyond doubt that this was the same Fokker biplane engaged by the British patrolling plane. But, if this confirmation had not been received, the combat would have been reported as "indecisive," and the German machine would not have been claimed either as "destroyed" or "driven down."

Again, a British scout pilot observed a German observation balloon guarded by two formations of machines. Guessing that these precautions indicated some especially important observation work, the British pilot determined on its destruction. One of the German patrols swooped down upon the approaching British machine which became the focus of a hail of bullets, one of which wounded the pilot. At this moment another British machine came to his assistance, and by skilful manœuvring the British scout extricated himself and again made for the balloon.

The second German patrol now took up the running and poured in machine-gun fire from all sides, once again wounding the British pilot. Side-slipping, zooming and spinning, he battled through the surrounding German machines, and reached the balloon. Hotly pursued by the German patrol, he put in a burst of machine-gun fire as he passed over the sausage, and had the satisfaction of seeing it go down in flames before he

made off towards the British lines, where he safely landed his machine and proceeded to get his wounds dressed.

An Interrupted Shoot

A British two-seater machine, in yet another instance, was engaged in directing a shoot from one of the British heavy batteries.

The ranging rounds had been fired, and the shells were bursting well on the German positions under bombardment, when the British flying officers saw a German scout shoot down a British balloon. Deciding that this must not go unavenged, the observer signalled to the battery to hold its fire and stand by. The pilot then made for the German machine, and, overtaking it, succeeded in driving it down to earth, where it was seen to crash.

The British machine then returned to the battery and continued the shoot.

Raiding an Aerodrome

While yet another incident of that glorious day was that of a British formation of ten machines which made a very successful job of a raid on a German aerodrome.

Determined to leave nothing to chance, the British machines descended to a height of 200 feet before releasing any bombs.

The result of this was that one shed was completely destroyed, a hangar was set on fire, direct hits were obtained on the German officers' mess, and two aeroplanes on the ground were severely damaged.

Coming down to 70 feet the British machines then proceeded to sweep the whole range of sheds and hangars with machine-gun fire, dispersing those Germans who still showed themselves in all directions and hitting many of them.

From Doubt to Triumph

Even the doings of the Royal Air Force in that week, of which this record day formed a part, are worthy to stand alone in a history of the war in the air, and they are all the more worthy as contributing materially to the gratifying—and surprising—victory, the cleanest, most valuable, and decisive of the

whole war, which the R.A.F. pilots and observers achieved over the German airmen in the summer months of 1918.

Space does not permit justice to that magnificent story. By circumstances, and not design, the writer is compelled to narrate only one or more striking incidents and periods. As that last year of the war developed, so the Air Force developed its mighty power, slowly but surely, until every German aircraft was driven from the battle skies. Month by month, we will see in the official monthly summaries, the number of Allied air victories multiplied and multiplied again, with an equal decrease in the total of Allied losses. In the chosen periods a single day of April, May, June and July, the first week in April, the third in June and in July, and the first week in August, the figures grew out of all proportion. While at the same time the airmen underwent their severest test of the whole five years of war—successful co-operation with the mutilated British 5th Army in the great March retreat.

Aircraft and the March Retreat

But the day before the disaster the British Commander-in-Chief had issued a personal order to all Army Commanders to convey to the Commander and all ranks of the First Brigade, Royal Flying Corps, his best congratulations on their splendid success in bringing down eighteen enemy aeroplanes in one day, and to state that he was very glad to hear that all our aeroplanes returned safely. Then the storm broke. For over a week the fate of the gallant airmen was left in doubt before the grimmer drama of the German hordes which were rushing on, irresistibly, in the direction of Paris. Public anxiety as to their safety had reached almost to breaking-point, when on March 26 the Air Ministry telegraphed to General Salmond, Commanding Officer of the Royal Air Force in France: "Congratulation to the Royal Air Force on the splendid work carried out by them during this great battle. We are all following their great deeds, and know that they will keep it going."

Tails Up!

To which reassuring message the young Air Force Commander's immediate and breezy reply was only characteristic

of the youthful service which he so ably commanded: "Very many thanks for Air Council's congratulations, which are most appreciated by all concerned. All ranks have their tails up, and the superiority of British over enemy airmen has never been more marked." Followed a peculiarly gracious message from His Majesty the King: "I wish to express to General Salmond and all ranks of the Air Service of the British Empire in France my gratification at their splendid achievements during the great battle. I am proud to be their General-in-Chief.—GEORGE R.I." And to which General Salmond again replied: "All ranks of the British Air Service in France desire to express their most loyal and heartfelt thanks for Your Majesty's most gracious message. They are specially proud to think that they are rendering good service to their King and Empire at this critical period of the war, and the knowledge that they have won the appreciation of their General-in-Chief inspires them to still greater efforts."

The year had opened auspiciously enough for the British airmen. In January 292 German and Austrian aeroplanes altogether had been brought down by the Allied airmen. British aviators on the Western battlefield, according to the *Times* summary, and naval airmen in fighter patrols, accounted for 144 enemy machines—86 destroyed by pilots and four by anti-aircraft gun and rifle fire, 53 driven down out of control, and one captured intact in our lines. Thirty-nine of our machines (including two naval aeroplanes) were reported as having failed to return, and the loss of three of them was attributed to collisions while over the German lines, while of the 273 aircraft of German and Austrian nationality brought down by Allied airmen the following month, if the number of enemy machines accounted for by British airmen on the Western front and naval airmen in fighter patrols was not so large as it was in January—the figures were 138 and 144 respectively—it must be stated by way of explanation that there were several entirely blank days during the month, and several others when flying was only possible for a brief period. But on those days when visibility was good the fighting was so intense as to recall the days preceding battles of Arras, Messines, Ypres, and Cambrai of the previous year. And as on those days, the successes of

British airmen were most marked. Four days in February stood out prominently in this respect—the 16th, 17th, 18th and 19th. On these four days British airmen brought down (that is, destroyed) 49 German aeroplanes and drove down 14 out of control (with more than a probability that some of them, at least, crashed), with a loss to themselves of only 12 machines missing.

Of the 138 German machines accounted for by the British 92 were destroyed (87 on the battle front and five by the R.N.A.S.), three were brought down by gunners and infantry, six landed in our lines, and 37 were driven down out of control (two by naval airmen). The British losses, as reported by General Headquarters in France, were 39 machines missing.

On February 26 the Air Ministry issued the following announcement:

"Western Front: From February 1 to 22 inclusive 75 enemy aircraft were brought down by the R.F.C. During the same period 30 enemy aircraft were driven down out of control—a total of 114. During the same period six enemy aircraft were brought down by anti-aircraft defences and infantry.

"Against these 120 machines of the enemy 28 of our own are missing.

"The weight of bombs dropped during the month up to February 22 has been 65 tons."

In the words of the official report, there was "no very great activity in the air during March." Climatic conditions generally were unfavourable for aviation. But several important dispatches were published, and at least one remarkable aerial battle occurred over the Western Front, the facts of which will prove of interest to the reader.

A comparison of the number of bombs dropped by British and enemy aviators on the Western Front in January was compiled—such matters always involved considerable time and consideration—and the totals published as follows:

	By Day.	By Night.	Total.
German	221	1,261	1,482
R.N.A.S., R.F.C., and Australian Flying Corps	5,900	1,753	7,653

While in February corresponding figures were as follows:

	British.	German.
By day	5,290	28
By night	3,553	1,768
	8,843	1,796

No more certain proof could be forthcoming of the British aviators' daring bid for the supremacy of the air. And not alone in bombing was this development manifest. In his dispatch—published March 4—dealing with the German counter-attack near Cambrai, November 30 previous, Sir Douglas Haig reported: "No steadily advancing barrage gave warning of the approach of the German assault columns, whose secret assembly was assisted by the many deep folds and hollows typical of a chalk formation, and shielded from observation from the air by an early morning mist. Only when the attack was upon us great numbers of low-flying British aeroplanes rained machine-gun fire upon their infantry."

The great March air battle over, the trenches saw almost an epic of the war in the air. Early on the morning of the 7th two British two-seater machines, encountering twenty-one enemy fighters, engaged them for over an hour, and actually shot down eight and sent down several others out of control. The two adventurers fell in first with a patrol of seven German scouts. While the battle was on, however, two other enemy patrols of equal strength hove in sight and joined in. The fight waxed fast and furious. Our two only broke off when all their ammunition was exhausted, and then, out of twenty or so Germans originally engaged, but seven were left in the air. Of the enemy machines certainly shot down four broke into flames in the air and four were seen to go straight to earth and crash.

The following day the same two British machines again fell in with a party of the enemy, of whom they shot down one and sent three more down out of control, so that the total "bag" for the two machines in two days was nine German aircraft destroyed and apparently an equal number driven down.

583 Casualties in April

Five hundred and eighty-three aeroplanes were reported down on all the battle fronts in April, as was pointed out in the monthly summary of the *Times*. All but one or two actually fell in that month. This was somewhat more than half the total for March, which, at 1,059, was the highest aggregate during the war, and most nearly compared with the 704 of September, 1917. Of the 583 the Allies claimed 470 and the enemy 113.

More than half the Allied "bag," 286 to be exact, fell to the guns of the British pilots, infantry and anti-aircraft defences on the Western Front, and against this 77 British machines were reported as missing. Our pilots destroyed 171 German aeroplanes in fighting and drove down 91 out of control. Twenty-three machines fell to gunfire (three coming down in our lines), and one large enemy bombing machine landed intact behind the British lines. As a whole, the fighting was not so intense on the British front as in March, but there was one day when it came very near to what Sir Douglas Haig described as "the most severe so far experienced."

That was April 12, when 40 German machines were destroyed by British pilots, 20 driven down out of control, and two shot down by the anti-aircraft guns—62 in all. The only occasion on which this total had been exceeded was March 24, when 69 enemy machines fell to earth—45 destroyed and 22 driven down out of control, and two shot down by the gunners.

The number of aeroplanes—1,248—reported as having been brought down on all fronts during May constituted a record for any month since the war began. Of this total 400 were destroyed by British airmen in aerial combat, and 101 driven down out of control; 15, of which seven fell inside the British lines, were brought down by gunfire, and four others were forced to land behind the British lines. In addition, eleven German observation balloons were destroyed. The number of British aeroplanes reported as missing in the same period was 128, inclusive of those which failed to return from raids into Germany.

The Royal Air Force in Being

Weekly Summaries in Four Months

Although these semi-official summaries convey to the reader some idea of the immense amount of work carried out by the flying men, they give no hint of its fluctuating nature. No two weeks' work were similar—for that matter, no two successive days. Aviation activity always came in rushes, or there was none at all. For this reason it has been necessary to select certain days and weeks to offer any conception which in any way visualises realities.

Air Records from the Front

For this purpose four days—April 3, May 1, June 1, and July 3—provide a most useful example.

The day of April 3 is particularly appropriate, though it is hardly possible to convey in writing any adequate impression of the intensely adventurous activity of the Royal Air Force daily routine during the April offensive operations in France.

The following are typical incidents; so typical, indeed, as to have been accepted by all concerned as routine features of one day's work too commonplace to call for any record.

A pilot flying a scout machine over the German lines was able, unperceived, to tail on behind a hostile formation of nine machines just leaving its own aerodrome. He followed without being noticed till the German formation met a British artillery observation machine on a lower level. Two of the German machines left the formation and dived to attack. Instantly the following English pilot swooped on one of them, getting in a burst from his machine-gun, which caused it to side-slip into and interlock with its companion. Following them up, he put in another burst, which sent them both crashing to earth in flames.

That same night two British machines, detailed for the purpose of watching a German aerodrome from which night bombing machines worked, sighted a hostile machine preparing to land. The enemy manœuvred frantically, vainly trying to evade the night hawks. Round and round the 'drome they circled, until finally, when quite low down, one of the British pilots was able to bring his machine-gun to bear. The German

landed—but as an inanimate part of a crashed and blazing machine.

Kite Balloon Attacks

In the afternoon the enemy, being hard pressed by Allied troops, and fearing for the safety of his observation balloons, began to move these back. A British scout sighted two of the "sausages" being towed by teams of horses. He was flying low, and a heavy fire was directed at him from the ground. Heedless of this, however, he dived still lower, and succeeded in setting one of them on fire. Driven from the remaining balloon by the increasing hail of bullets, he next directed his attention to an anti-tank gun. The gunners hastily limbered up, but his fire stampeded their team, and the gun was upset in a ditch. By this time he had been wounded twice, but noticing various parties of infantry concentrating in the vicinity, he attacked and dispersed them before returning to his aerodrome.

Another pilot, seeing a party of Germans collected in the open, descended to investigate, and found that they were exulting over a British machine that had been brought down in their lines. A bomb released from a height of only 100 feet effectively dispersed them, after which he dropped three more bombs on other parties of troops near by. During this performance, however, his machine was so severely damaged by rifle fire that he soon had to descend alongside an English cavalry outpost. Not yet having exhausted his enthusiasm, he procured a rifle and put in some dismounted cavalry fighting before borrowing a horse and returning to his aerodrome.

An American pilot attached to a British squadron was returning with an English observer from a bombing raid the same day when they were attacked by two formations of enemy scouts. The first German machine to close was at once shot down in flames by the observer, to be followed closely by another, which was attacking from the rear. A regular dog-fight ensued, during which two more hostile machines were so damaged that they spun downwards and were seen to crash. Naturally, in such an encounter the British machine was badly shot about, but, luckily, neither occupant was hit, and the pilot

was just able to land his war-worn craft safely behind our lines.

And one more incident of that happy day: an English two-seater was on important reconnaissance work, and in spite of furious Archie fire, remained over the position to get the required information. At last an unlucky shot pierced the petrol tank. The petrol spurted out and saturated the pilot. Realising the instant danger of fire, the observer climbed out on to the lower plane and succeeded in plugging the hole with his glove. Banking and side-slipping to disconcert the gunner's aim, the pilot headed for the British lines, still with his observer grimly clinging to the plane and holding the improvised plug in place. Here he remained until the pilot had crossed the lines and effected a safe landing.

These, let it be said, were not exceptional incidents, but were simply taken at random from the Royal Air Force routine reports of that day.

May 1 offered an equally satisfactory record. Early that morning, by extremely skilful gunnery, the officers in a British two-seater shot down a German Fokker at unusually long range.

Diving after it in order to ensure that it should be completely destroyed, they entered a thick cloud. Suddenly, right ahead, and only a few yards from them, another German machine loomed through the mist. Simultaneously the guns on each machine spoke, but not more than half a dozen rounds could be fired before the planes were almost touching each other. Too late, the pilots pulled their respective machines aside; as they flashed past their wings splintered in mid-air.

The German machine was seen to fall headlong. The British machine, by reason of a badly damaged right wing, became unmanageable. Then the English observer did a very risky thing—the only thing that offered a chance of saving the machine. He climbed out on to the splintered wing, and so balanced it that his pilot was enabled to bring the machine down safely behind his own lines.

An English scout pilot flying alone over the German lines a few miles distant was attacked by three Fokkers. Evidently the Germans were experienced pilots, for they pressed him

hard. The Englishman endeavoured to separate his opponents, but they were too cautious to fall into his trap, and studiously maintained their formation.

Rolling and spinning, the English machine had come within little less than 100 feet of earth, when the pilot performed a manœuvre totally unexpected by the Germans. He suddenly banked steeply round upon his pursuers. In their endeavour to escape collision with the English machine, two of the German planes collided, and the English pilot brought his machine—though badly shot about—safely to his own aerodrome.

Clearing a Trench

During a pause in the infantry fighting the observer in a British two-seater machine noticed that a party of the enemy had established themselves in a trench in advance of the general line of their front, and were busy consolidating the position.

There were no British infantry immediately available to evict the Germans, and to have waited until troops could be sent up would have meant allowing the position to be made very much stronger. In other words, British lives would have had to be paid for it.

The British officers, therefore, decided to do the work themselves, and, diving low and flying along the newly-made trench, they opened a hot fire with their machine-guns. In spite of heavy answering fire from the ground, they repeated this operation, causing many casualties, until the surviving Germans, about fifty in number, scrambled from the trench and bolted eastwards. As they fled the machine followed them up and took a further heavy toll before returning to the British lines. A little later British troops, at no cost to themselves, occupied that half-made German trench, consolidated, and held it.

Effective Work with the Guns

The following incidents, which occurred during a single patrol of an artillery observation machine, were typical of this less conspicuous but equally important section of R.A.F. work.

The officers in the machine in question began their work by locating four German batteries in succession, reporting to their own gunners and directing the fire that presently put all four batteries out of business. Flying farther over the hostile area,

they observed a large concentration of enemy troops, consisting of over 1,000 infantry and 30 motor lorries. An emergency call was sent down to the artillery, and every available British gun was turned on to the mass. The resultant firing caused indescribable damage and confusion, and the survivors of that German unit scattered wildly over the country-side, the unit as such being effaced.

Before returning home this same patrol sent down five other "fleeting opportunity" calls, enabling fire to be opened upon other German troops and transport on the march. It was a typical and deadly two hours' work.

Long Odds

An English scout pilot, late that same afternoon, engaged and shot down a German machine. He followed it down to 500 feet to make sure of its crashing, and then, as he was climbing west again he was attacked from above by no fewer than seven Fokkers, a position which he might have been excused for regarding as hopeless. But he did nothing of the sort.

All seven German machines dived on him, pumping out bullets, but fortune favoured the brave, and not one secured a vital hit. The English pilot was now above, and without a moment's hesitation he dived into the midst of the enemy, firing in succession upon each Fokker upon which he could get his gun to bear. His fire was more successful than that of the Germans, for the right wings of one Fokker crumpled up in mid-air, and another spun down out of control, both being seen by another pilot to crash.

Then, before the remaining five Germans could collect themselves, the English pilot was well on his way towards his own lines.

An Australian bombing patrol's destruction of a German column of transport from a height of only 600 feet was the feature of the aerial activity of June 1.

A British reconnaissance machine, while flying well behind the German lines, observed a very large column of transport on the road. The British machine was carrying no bombs at the time, so a neighbouring Australian squadron was called

up by wireless and informed of the opportunity for putting in useful work.

Within a very few minutes nine machines had left their 'drome. A few more minutes and, piloted by the reconnaissance machine, they were over the German transport. Descending to 600 feet, they rained bombs on the crowded road beneath, finishing the work of destruction with their machine-guns. Wagons were overturned, horses stampeded, and very many casualties were caused among the personnel of the column.

On the way home the same formation, having a few bombs left, deposited them upon an opportunely discovered ammunition dump, which they left well alight.

An Artillery Flight

The work of the R.A.F. in connection with the artillery went steadily forward day by day, and though it did not lend itself so readily to opportunities for personal distinction, it was quite as essential as that done by the fighting and bombing machines. The amount of work put in by these machines was very great, and its effect upon Allied progress was most important.

One machine began operations this day by carrying out a shoot with a British siege battery. As a result the German gun position was completely destroyed after 39 rounds, a large explosion and an extensive fire being caused.

Another position was then engaged, which was also set on fire and put out of action. Just as this second shoot was completed a third German gun position was seen to be active, and the observer signalled for the fire of the battery to be switched on to it. The result was satisfactory in that this third position was so far damaged as to bring its activities to an abrupt conclusion.

This alone would appear a good day's work, but the two British officers were not yet satisfied, and they co-operated in the task of engaging and silencing three more batteries and exploding one ammunition pit before returning home.

A British scout pilot about the same time had boldly attacked several German Fokkers. By a headlong dive into

the enemy formation he scattered its components, and then, selecting one victim, he poured burst after burst of machine-gun fire into it as he followed it down. Determined that it should not escape him, he drove it to the ground, where it crashed hopelessly.

He had pressed it so closely that he was now just above a party of German troops who had collected to watch the fight. Apparently the Germans had rushed out without any arms, for they began to pelt the British pilot with stones. Needless to say, his machine-gun made a suitable and more effective response.

Destroying a Train at Night

A British two-seater machine that night went roaming over the German back areas. The night was dark and the usual landmarks could not be seen. The flying men simply knew they were somewhere in the vicinity of a German railway.

They shut off their engine and planed down, listening intently. Presently the puffing of an engine could be heard. Descending still lower they dropped a parachute flare, which revealed a long troop train beneath. Then their bombs were released. Subsequently, by the light of a second flare, they were able to see that the train was completely wrecked.

Before leaving the scene they completed their night's work by diving yet lower and scattering with machine-gun fire the German troops that had escaped from the train.

Three in Five Minutes

Another British scout whilst on patrol suddenly came upon a formation of nine German machines about to attack a couple of British artillery machines beneath them.

Without hesitation the British pilot dived, and the first German machine upon which he opened fire went spinning earthward. Next he turned his attention to a triplane, and after a brief fight that also was driven down—this time in flames.

Continuing his dive, he reached a group of three Fokkers, which he engaged. Here again a short struggle resulted in

the wing of one more German machine crumpling up in the air as it fell to destruction. The remainder of the Germans then drew off.

Thus, within less than five minutes, this single British pilot succeeded in completely destroying three German machines and in dispersing a total formation of nine.

July 3

In detail there was but little difference between the work of this day and that of July 3—save, perhaps, that the British aviators were even more active on the latter date.

The difficulty about presenting any such records as these is to avoid, on the one hand, any appearance of picking out exceptional incidents, and on the other, seeming to attach undue importance to happenings which were strictly normal, average, typical items in the day's work of the Royal Air Force in the field. These were merely the latest samples from a stock which each day's records renewed.

German observation balloons had a bad time on July 3rd. One British pilot, scouting behind the enemy's lines, pounced on two of these balloons in swift succession, and succeeded in setting fire to and destroying both. His petrol was beginning to run low at the time, so he returned to his aerodrome to refill. But his appetite for German "sausage" was apparently unslaked, for he set out immediately upon a second quest, sighted two more balloons, and, taking advantage of friendly clouds, carefully stalked them. When within a short distance of his prey cloud cover failed him and he was perceived. The Huns rushed to the winches and endeavoured to haul down both balloons. Putting down the nose of his machine, the British pilot sped earthwards after the swaying mass of fabric, and almost before the German mechanics had their winches working the hunter had secured his first quarry, which fell a blazing mass upon the Huns beneath. The other balloon was rather farther away, and the Germans, stimulated to frantic efforts by the fate of the first, hauled desperately and succeeded in getting it down almost to the ground before the British pilot arrived above. Not to be baulked of his prey, and in spite of furious fire from below, he dived low enough to pump in a burst of incendiary bullets,

and had the satisfaction of increasing his bag for the day to four enemy balloons totally destroyed.

During their retirement the Germans made desperate efforts to remove as much ammunition as possible. A British pilot spotted a train of wagons engaged on this work, and descending into position, he opened fire on the rear wagon, knocking out two men on the box. Deprived of their drivers, and terrified by their winged assailant, the horses bolted, and, colliding with a tree, upset the wagon.

An extremely heavy fire was by this time being directed upon the airmen, and had already wounded him in the knee and severed the pressure feed pipe of his machine. He would not leave his job half done, however, and again manœuvring into position put in another burst, which resulted in the overturning of two more and the stampeding of the remaining wagons.

A Four-to-One Chance

On the same day a British machine, working in conjunction with the infantry, was attacked by four German scouts. This being about the odds which German airmen now demanded, they doubtless thought they had found an easy prey. It was, of course, true that the British contact machine was not primarily designed for fighting purposes, but its pilot on this occasion, as always, was ready to give a good account of himself, and did so to such purpose that one of the attackers was speedily sent down out of control. During the fight the petrol tank of the British machine was pierced, giving instant menace of its destruction by fire. Thereupon the English observer promptly climbed out on the lower plane and successfully plugged the hole with his handkerchief, remaining on the plane until his pilot succeeded in throwing off his pursuers and landing his machine safely behind the British lines.

The Night Hawk

A British two-seater machine, hovering that night over an enemy concentration centre, observed—easily distinguishable in bright starlight—a column of transport consisting of about 20 wagons. Descending rapidly to 300 feet he landed two bombs—a hundredweight apiece—plumb in the centre of the

column. The destruction was enormous, and the remnant of the column scattered wildly in all directions. The British pilot rose again and waited, giving time for the German transport to reassemble. Diving once more, he found it, together with two other large lorries, in a sunken road where the Huns apparently hoped to escape further attack from the death-dealing raider. The British pilot released his remaining bombs from an altitude at which he could not miss his target, and then, diving lower still, opened fire with his machine-guns, putting about 250 rounds into the confused mass of wreckage.

The "Balloonatics"

Balloon officers, though performing vitally important work, did not often come into the limelight of publicity.

On July 1, however, two British officers were at work in a "sausage." The Germans, resenting their attentions, turned two guns on to their balloon and made some rather good practice, holing it badly. This annoyed the English balloon officers considerably, and they decided that the German gunners needed punishment. They accordingly called up the officer in charge of a British 6-inch gun and indicated to him the position of the German guns. The balloon was now rapidly losing height as the result of enemy fire, and the position of the officers was dangerous. However, they stuck to their basket and continued to direct the fire of the British gun, having the satisfaction of witnessing the putting out of action of one of the hostile guns before the balloon had sunk too low for further observation.

Then they got out of their basket and climbed well up the rigging of the balloon to save themselves in the now unavoidable crash.

Varied Activities of One Week

From the aerial standpoint the results of the fighting during the first week in April must have been profoundly disappointing to Germany.

In the West it was a week of heavy and destructive raids, not only upon an ever-growing circle of German towns in the Rhine provinces, but upon points of vital military importance behind the battle lines and upon the coast of Belgium.

The Royal Air Force in Being

Throughout the week the Western Front remained the storm centre of the war, and it was here that the heaviest aerial fighting took place. Some idea of the intensity of this fighting can be gathered from the fact that during the week 76 enemy machines were brought down and 15 driven down out of control, 51 British machines being reported missing. Notwithstanding the repeated efforts of the enemy to restrict the British field of observation and to detain our forces during the progress of important events elsewhere, British airmen made a very large number of reconnaissance and offensive flights, taking many thousands of photographs and dropping over 154 tons of bombs, including 13 tons upon Estaires and Merville, 12½ tons upon Armentières, Mericourt and Bray, and upwards of 20 tons upon the railway systems at Lille, Cambrai, Seclin, etc.

In addition to these most successful local raids, British airmen carried out a large amount of counter battery and offensive patrol work, engaged some hundreds of enemy machines for destruction, and attacked an immense number of ground targets with machine-gun fire.

It is a notable commentary upon Britain's now growing power in the air that, despite the utmost defensive efforts of the enemy, British airmen continued, week by week, to attack the German naval and submarine bases on the coast of Belgium. This week showed no diminution in the severity or the success of these attacks. Vital military objectives were repeatedly bombed, both by day and night; upwards of 20 tons of bombs being dropped upon the mole, harbour and workshops at Zeebrugge, the power station at Ostend, the canal and docks at Bruges, Ghistelle's aerodrome, Middelkerke, Engel dump, etc

Bombing Activity

A feature of the week was the remarkably large number of bombing raids made by the R.A.F. into German territory. Whether judged by the number of towns visited, the tonnage of bombs dropped, the distance covered or the material damage caused, the week's work constituted one of the heaviest records of long-distance bombing of the war. Twenty-five separate raids were made. Among the military objectives attacked were

the railway station and sidings at Thionville (four times), the famous poison gas factory at Mannheim (twice), the Benz works, the Lanz chemical works, and the Gedruder Guilini munition factory at Mannheim, the works and blast furnaces at Burbach (twice), the railways and factories at Offenburg (twice), the railway station at Heidelburg, the powder factories at Rottweil and Oberndorf, furnaces at Wadgassen and Hagondange, the aerodromes at Boulay, Dieuze and Morhange, etc.

The highly destructive character of these raids was emphasised by photographs secured by British airmen both during and after the attacks. This was notably the case at Thionville, where a fire, starting among the rolling stock, spread rapidly towards the river, completely destroying the goods station and other important buildings. Fire was also seen to break out at the Benz works and the Badische chemical factory at Mannheim, while dense clouds of smoke were also seen to emerge from the Gedruder Guilini munition factory, which was hit during the same raid.

June Aerial Ventures

Activity ruled in all branches of the Royal Air Service during the week ending June 13th, a week which was dominated first by the long-prepared yet markedly barren German offensive, and then by the swiftly improvised but brilliantly successful Franco-American counter-offensive.

In the Western zone of operations, which included the Belgian coast-line and the British front in France, the weather had been consistently bad throughout the week, greatly impeding air work both on land and sea.

However, as an illustration of the way in which the British airmen turned even the most adverse conditions to good account, the series of bombing raids made upon the German naval organisations at Zeebrugge, Ostend and Bruges deserves special note. Such raids were always fraught with considerable peril for the attacking squadrons. The entrance to the Zeebrugge-Bruges canal, not to mention other equally vital points, was notoriously one of the most strongly fortified positions in Western Europe.

To ensure hitting their objectives, the British airmen flew

very low, where they presented a tempting target for the German gunners. Strong winds prevailed, adding difficulties to the work of the pilots which were not encountered in fair weather.

In spite of these handicaps, British bombing formations attacked again and again, inflicting heavy damage, and visiting some of the objectives twice and even three times in twenty-four hours. During the course of these operations Bruges docks were heavily bombed, and a fire, which continued for several hours, started at La Burgeoise works. The naval works at Ostend and Zeebrugge were the objects of numerous attacks, a large number of bombs being dropped upon the mole and lock gates and upon shipping in the adjoining docks and harbour.

Work Along the Coast

A significant feature of the raids had been the attacks, on two successive days, upon dredging parties engaged near the entrance to the Zeebrugge Canal. A photograph taken about this time showed that despite their utmost efforts, the Germans had been quite unable to remove the obstruction caused by the British block ships sunk in the fairway of the channel the previous month. British airmen by their incessant raids upon Zeebrugge without doubt contributed largely to this delay. Some indication of the growing concern of the Germans about the success of these raids is given by the fact that large formations of enemy machines repeatedly attacked our squadrons, without, however, being able to prevent them from achieving their object. In the course of a single fight over Zeebrugge, three enemy machines were brought down and two driven down out of control, two British machines only being reported missing.

Hardly less striking were the results of the week's fighting on the Western land front. The R.A.F. made fourteen bombing raids into German territory. Among the places attacked were the aerodromes at Boulay (twice), the railway sidings and sheds at Offenburg and Thionville (twice each), the aerodrome at Freiburg, the sidings at Saarburg, the works at Hagendingen and Burbach, and other important objectives. Several big fires

were started, and in two instances ground targets were heavily attacked with machine-gun fire.

In the battle region, notwithstanding the frequent storms which swept across Northern France, British airmen took advantage of every practicable interval to secure effective observation and to deliver a series of telling blows at vital enemy positions behind the lines. Many successful raids were made, during which 85 tons of bombs were dropped, including 15 tons upon the railway junction at Roulers, and upon ammunition dumps at Warneton and Bapaume. In the course of aerial fighting 50 enemy aircraft were brought down and 15 driven down out of control. Twenty-one British machines were reported missing.

The week's record of British offensive work in the air would be incomplete without some reference to the large amount of photographic, reconnaissance and patrol work carried out by our airmen on all fronts. The fact was often overlooked that a considerable part of the dramatic air fighting, which loomed so largely in the official communiqués, was really undertaken in defence of squadrons engaged upon the vital work of reconnaissance and artillery fire direction. This work, which although only occasionally mentioned, was hardly less dangerous than that of our fighting scouts, called for the same high personal qualities of initiative and daring, and was of incalculable value to the army both in offence and defence.

The British air patrol, whether engaged in directing battery fire on land or spotting submarines at sea, was doing work of a vital character, upon which the offensive power and, indeed, the safe defence of the Empire depended.

Fierce Battles of the Skies

If the bringing down of enemy machines had been the primary aim of the British Air Service (which, of course, it was not), the figures for the week ending July 17 alone would have been evidence of a most successful seven days' activity.

In the course of air fighting over Northern France and Belgium, British airmen destroyed 124 enemy machines, drove down an additional 46 out of control, and shot down 34 German kite-balloons in flames, thus accounting for a total of 194 enemy

aircraft in one week. In the same period 90 British machines were reported missing.

Readers, however, should never lose sight of the fact that the most vital work of the Royal Air Force, the work which left an unmistakable impress upon the events of the battlefield, was of a kind which did not lend itself to statistical statement, and which frequently did not appear in the *communiqués* at all.

As an illustration of this, the quite remarkable achievement of British airmen engaged upon photographic reconnaissance over the enemy's lines may be instanced. The magnitude of this work can be judged from the fact that between eight and nine thousand aerial photographs were taken during this week —many of them of positions far behind the immediate fighting zone—of which more than 5,000 were secured during the relatively short period of fifty-six hours.

Photographic Incidents

It was noteworthy that so large a number of photographs should have been taken in so short a time, but it was even more noteworthy that at the zenith of a battle of unprecedented magnitude and fury, when the enemy was exhausting every resource to hold back the British advance, and during which immense exertions were demanded of the Air Service, British airmen should be quietly and systematically preparing the way for further advances by photographing the enemy's vital positions in Belgium, on the line of the Meuse, and at other points far behind the battle lines.

Herein lay one of the unique distinctions of the Air Force, that its duties combined active participation in the battles proceeding on hand with a vast work of simultaneous preparation for operations yet to be undertaken. For in a war of movement, such as this was, the back areas of to-day might well be the battle-zone of to-morrow.

The very formidable activities of the British bombing squadrons should by no means be overlooked. Thus during this week nearly 300 tons of bombs were dropped upon German railways and other military organisations between the coast and the Somme. Of these well over 100 tons were discharged between sunset and dawn, causing much damage, and seriously

interfering with the enemy's night transport both of troops and supplies.

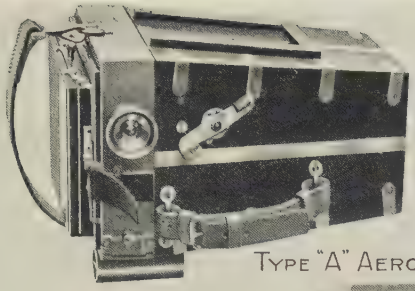
In this connection the carefully timed air-offensive against the important railway and road centres behind the German front from the sea to Armentières was of especial interest. Acting in close concert with the plans of the Belgian High Command, British coastal squadrons, on September 28th, attacked with great vigour the railway communications at Thourout, Cortemarck, and Lichtevelde, on the direct routes from Bruges and Ostend to the retreating German line.

Throughout the day enemy reinforcements, hurrying to the threatened sectors, were attacked with bombs and machine-gun fire. The permanent way was destroyed in many places. Three trains were partially destroyed by fire, and direct hits secured on four others. Three large enemy ammunition dumps were exploded, and columns of horse transport were stampeded, while heavy casualties were caused by bombs bursting in the midst of bodies of massed troops.

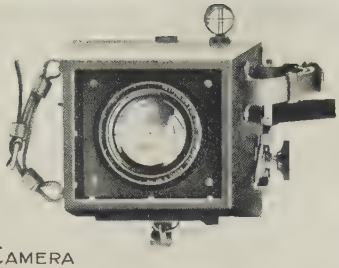
Here, as upon other sectors of the Western Front, British airmen did much useful work throughout the week, observing for the advancing artillery, co-operating with the infantry and tanks, reporting the enemy's movements, and in many other ways assisting to maintain the remarkable co-ordination between all arms which was such a striking feature of these July operations.

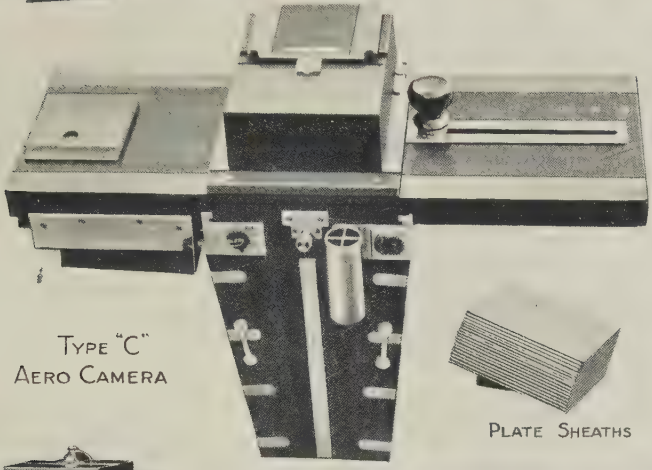
On the opposite flank of the immense salient stretching from Roulers to the Lorraine frontier, the R.A.F. Independent Force lent its powerful aid to the 1st American Army by attacking the vital enemy railway communications south of Luxembourg. The sustained character of these attacks can be gauged from the fact that in the twenty-four hours ending at dawn on the 27th no fewer than fifteen separate raids were carried out as follows:

7 raids upon the railway triangle at Metz-Sablon.
2 ,, ,, ,, junction at Thionville.
2 ,, ,, ,, railway at Mézières.
1 raid ,, ,, ,, ,, Audun-le-Roman.
1 ,, ,, ,, ,, ,, Ars.
2 raids ,, ,, aerodrome at Frescaty and Plappeville.



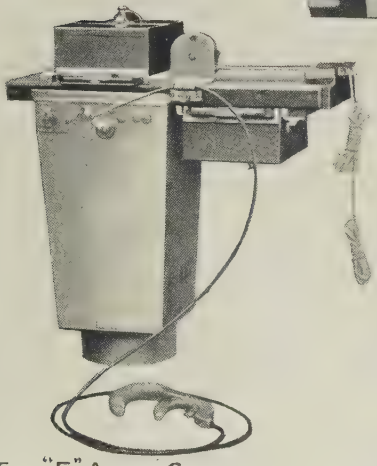
Type "A" Aero Camera



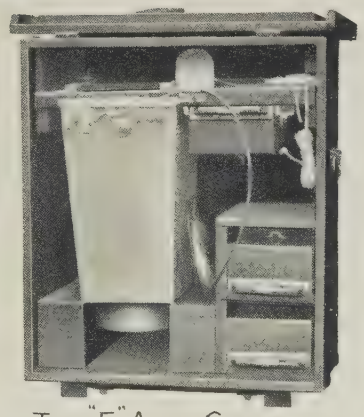


Type "C"
Aero Camera

Plate Sheaths



Type "E" Aero Camera



Type "E" Aero Camera
In Storage Case With Extra Plate Magazines

TYPES OF AEROPLANE CAMERAS

Aerial photography was developed wonderfully by the R.A.F., and above are shown some of the cameras used. These were designed and built by the Thornton-Pickard Company. Over 6,000,000 photographs were taken with similar types of camera, from heights ranging up to three and a half miles.

Heavy attacks were also made during the week upon the blast furnaces at Burbach and the important railway junction at Treves.

July Aerial Operations

It was not always realised how much the success of a big offensive such as that launched by the British and French troops under Sir Douglas Haig this first week in August depended upon the work done in the air during the critical days which preceded the attack.

In this respect the aerial events of the week were of special interest, for it was a week of severe air fighting throughout the British sector of the front, in which British airmen not only engaged enemy forces over hostile territory, but defeated them in the most signal fashion. It was solely due to this fact that the immense amount of photographic and reconnaissance work, necessary to the success of the offensive, was effectively carried out.

Enemy's Defeat in the Air

As an illustration of the formidable character of this fighting, it may be mentioned that on three successive days the number of German aircraft destroyed by the British on their own sector of the Western Front were 15, 26, and 11 respectively. In addition to these 52 enemy machines known to have crashed in three days, 18 further machines were driven down out of control during the same period, while a number of kite-balloons were shot down in flames. Twelve British machines failed to return. For the week, taking all fronts together, 92 enemy machines were destroyed and 36 driven down out of control, 17 British machines being reported missing.

The Meaning of the Fighting

Thus throughout the week British airmen had been bringing home reports of considerable railway activity behind the German lines. There can be little doubt that this activity had been concerned chiefly with the movement of enemy reserve troops from the Flanders and Lille areas. To prevent our observation of these movements, and especially to prevent our attacking the

railway transport, the enemy threw considerable air forces into the fight, with the result that a large number of his machines were sacrificed without, however, achieving his purpose.

In conjunction with our fighting scouts, strong British bombing squadrons throughout the week attacked successfully the railway organisations of the enemy, dropping upwards of 140 tons of bombs and causing much material damage.

British attacks also were made with marked effect upon the enemy's aerodromes in the battle area. In one case six hangars and sixteen machines were set on fire, and one machine blown to pieces on the ground.

The Camera's Part in the Offensive

Much of the success of the British offensive was undoubtedly due to the accurate information of the enemy dispositions supplied by the many excellent photographs secured by the British airmen. Nearly four times as many photographs were taken this week than during the preceding seven days, notwithstanding the greatly increased resistance of the enemy. This fact alone illustrates how assured was the ascendancy already established by our airmen over the German aviators.

Although little was heard of the R.A.F. photographic section in the official *communiqués,* it is no exaggeration to say that the achievements of this branch constituted one of the minor wonders of the war. For the excellence of its apparatus and equipment, for the skill of its trained personnel, and for the amazing celerity of its operations, it was universally regarded as a model of its kind. It was no uncommon performance in the Royal Air Force for a dozen or more finished enlargements of a new enemy position to be in the hands of the Intelligence Staff within forty-five minutes of the plate being exposed in the air.

That the Germans themselves were deeply conscious of British superiority in this respect was shown by a recently captured German order in which special attention was drawn to the various ways in which enemy secrets were continually being disclosed by British cameras, and they were giving strict injunctions to guard against this.

The Year in the Air (1917–18)

In view of these varied facts as to the work of the British flying men on the Western Front in the earlier stages of the war, the reader may find it interesting to make a comparison with the following official report on aerial activities during a period from July 1, 1917, to June 30, 1918:

"Two thousand one hundred and fifty enemy aircraft," it was stated in this report, "have been destroyed by the British on the Western Front alone, whilst 1,083 enemy aircraft have been driven down out of control. During the same period, Royal Air Force units working in conjunction with the Royal Navy, have shot down 623 enemy aircraft. Of our machines, 1,094 have been reported missing, whilst of those working with the Navy 92 have been missing. Thus, in the north, during the year the British alone have accounted for no fewer than 3,856 enemy machines, the number of British machines missing being 1,186.

"Turning to another theatre of war, during the period of April to June of this year, on the Italian Front, the British have destroyed 165 enemy machines and driven down six out of control, whilst British machines missing were 13. On the Salonica Front, between January and June, 21 enemy aircraft were destroyed and 13 driven down out of control, whilst British machines missing were four.

"From March to June, in Egypt and Palestine 26 enemy aircraft were destroyed and 15 driven down out of control, 10 British machines being missing. Thus, during the present year, in these outside theatres of war, 246 enemy aircraft have been accounted for, whilst 27 British machines were missing. So that between July, 1917, and July, 1918, the British have brought down very considerably over 4,000 enemy aircraft, whilst British machines missing have only slightly exceeded 1,000.

"Remarkable as had been the progress made in aviation during the war, it must be admitted that we never reached the stage at which all aerial operations were quite independent of weather conditions. In effect, there were, from the airman's standpoint, two kinds of days—flying days and 'dud' days. In the same way the night-flying airmen divided each

month into ' light ' and ' dark ' periods, according to the phases of the moon.

"These facts require to be borne in mind in reviewing these astounding figures. One fact emerges clearly from all records of aerial operations, and that is that British superiority and strength in the air in all the theatres of war have progressed rapidly and continuously.

"In aerial warfare, more perhaps than in any other branch, there can be no standing still. Having regard to unavoidable war wastage, mere maintenance demands great and unceasing effort. But continuous expansion is what is needed, and that, in conjunction with maintenance, is only possible as the result of uninterrupted co-operation and complete devotion to the end in view, on the part of all the multifarious groups of workers of all grades connected with the war in the air."

Some Incidents

In the official reports of aerial warfare such phrases as: "Splendid example and fearless leadership," or, "Continuously successful and skilful"; or, "He fought with great dash and skill"; again, with "Conspicuous gallantry and devotion to duty"; or, "He obtained valuable information under the most difficult weather conditions"; or again, "He has always shown the greatest determination and gallantry" are of frequent occurrence.

Every branch of aerial activity is represented. There are immortal instances of life-saving, at great personal risk, in No Man's Land and amidst equally dangerous and difficult conditions at home. Night flying adventures lend an added tinge of interest to the category. Such Homeric deeds are recorded as that of a lone British aviator who attacked ten German machines at one time. Another concerns a gallant young pilot, who, when bombing, swept down to within 150 feet of the ground to make sure of his objective. There are examples alike of fighting in mid-air, contact patrols, and incidents of reconnaissance. While, undoubtedly, the most satisfactory record of all about this time was that of the men in the ranks.

Gallant Deed of Pioneer W. T. Smith, R.E.

In the words of the *London Gazette* it was "for conspicuous gallantry and devotion to duty whilst acting as aerial gunner to an officer," that Pioneer W. T. Smith was awarded the Distinguished Service Medal. Having shot down an enemy machine, his own pilot was wounded and fell forward insensible on the control lever. Pioneer Smith, without hesitation, climbed forward along the plane, pulled his unconscious pilot off the lever, and somehow or other again got the machine under control. The officer then partially recovered, whereupon he remained standing on the side of the *fuselage* shouting words of encouragement to him, and the machine eventually was landed without much damage, entirely owing to his exceptionally gallant and prompt action.

Off Duty Gallantry

Not every gallant deed, as was popularly supposed, was performed to the accompaniment of bullets whistling past the aviator's head, the machine travelling break-neck speed through the air; and in the midst of an Homeric duel among the clouds. None the less they were as useful as daring, and as splendid in their achievement. Major Bearne and Private Usher's gallant rescue in Serbia, and that of Lieutenant F. S. Smith and Sergeant W. E. Rhodes, both of the R.F.C., at an aerodrome in France equal any story of mid-sky.

A bomb accidentally exploded in the mouth of a dug-out forming a bomb store, which contained a large number of bombs packed in wooden cases and a quantity of rockets. Two men were killed by the explosion, and another man, who was severely injured, was thrown down into the store. Dense columns of smoke issued from the dug-out, and there was great risk of a further explosion, Lieutenant (then second lieutenant) Smith, on hearing a call for help, immediately entered the dug-out, followed by Sergeant Rhodes, and succeeded in rescuing the wounded man, who would otherwise have been suffocated.

A French motor-lorry, loaded with 3,000 lbs. of aeroplane bombs, which caught fire in the middle of a camp of the Serbian Army, gave Major L. G. Bearne, D.S.O., and Private A. E.

Usher their great opportunity. Efforts to beat out the flames with earth proved ineffectual, and after the fire had been burning for seven or eight minutes, and the bomb cases were already involved, Major Bearne and Usher ran up with extinguishers. Both immediately crawled underneath the lorry and eventually succeeded in extinguishing the flames, thus averting a serious disaster at the risk of their own lives. Major Bearne was severely burnt about the hands and arms.

Bombing and Combat Adventures

Bombing, fighting, reconnaissance and photography; low and night flying; the incident of a British aviator who fought ten Germans single-handed; that of another who came down to 150 feet to drop his bombs, all differ but slightly in theme, and little more in detail. "Contact," as it was technically known, implied aerial co-operation with the infantry in their trenches. One "contact" pilot, Second Lieutenant W. L. Douglas, repeatedly displayed the greatest fearlessness and determination in attacking German troops from a low altitude, disregarding the attacks of hostile machines in superior numbers and adverse weather conditions, in order to obtain satisfactory photographs. Said the *London Gazette* of Lieutenant Douglas, on the award of a well-merited M.C.: "for conspicuous gallantry and devotion to duty in carrying out a large number of very successful photographic reconnaissances."

Of another reconnaissance aviator, Lieutenant B. C. Grimwood, it stated that: "having located a strong force of enemy infantry coming up to counter-attack, his machine was immediately afterwards hit by a shell, which wounded him severely and destroyed his wireless apparatus. His machine was obviously so damaged that no expert would have believed it could have possibly held together in the air, but in spite of this and of his wounds, he wrote out a message reporting the position of the enemy, and dropped it on divisional headquarters, who were able to put nine batteries on to the target. His pluck and devotion to duty were worthy of the highest praise."

While of another, Lieutenant E. Gribben, a battle pilot, it was reported that he was awarded the M.C. "for conspicuous gallantry and devotion to duty on offensive patrols. In every

combat he has been most conspicuous, continually attacking superior numbers of the enemy, destroying some and driving others down out of control. He fights with great dash and skill, and whenever any machine of his formation is in difficulties, he is invariably at hand to render assistance."

A Night Flying Incident

Incidents of night flying differed but little in main essentials from those of the daylight hours, while daring feats in which both observer and pilot equally shared honours were not infrequent. For instance, Lieutenant A. J. Arkell, when, during a hostile aeroplane raid, he and his observer Private Stagg, while on patrol, sighted a Gotha machine at a height of 10,000 feet. He opened fire at a range of 200 yards, and so manœuvred his machine as to give his observer, despite a vigorous fire being continually poured on to his machine from the enemy aeroplane, a target which offered the best possible advantage for attack. Private Stagg then opened a heavy fire upon the enemy aeroplane at close range, as a result of which the enemy machine burst into flames and crashed to the ground. Lieutenant Arkell showed the utmost coolness and courage during the engagement, the result of which was to cause the enemy machine to be brought down.

"Conspicuous gallantry" was evinced by Captain C. J. Brand, M.C., when on night patrol he encountered an enemy aeroplane at a height of 8,700 feet. He at once attacked the enemy, firing two bursts of twenty rounds each, which put the enemy's right engine out of action. Closing to a range of twenty-five yards he fired a further three bursts of twenty-five rounds each, and as a result the enemy machine caught fire and fell in flames to the ground. Captain Brand showed great courage and skill in manœuvring his machine during the encounter, and when the enemy aeroplane burst into flames, he was so close that the flames enveloped his machine, scorching his face.

One Against Ten

Captain F. H. Lawrence, while leading a patrol of eight scouts, which were protecting a number of bombing machines,

attacked ten enemy machines, driving one down in flames and preventing the bombing machines being interfered with. On another occasion he attacked five enemy scouts, bringing one down in flames. He brought down two other machines, and at all times showed the greatest coolness and courage.

On one occasion, Lieutenant J. S. Michie attacked a German two-seater while it was leaving the ground and forced it to dive. He then from a height of 150 feet dropped his bombs on the machines on the aerodrome, destroying one. His machine was hit in the petrol tank and touched the ground, but he recovered and led his patrol back safely. On another occasion he attacked three hostile scouts, bringing one of them down. He also carried out numerous actions on enemy troops and led many patrols with great success.

Aerial Rescues from No Man's Land

Even this list, however, would not be complete without the story of the two great rescues effected by air of two crews and machines which fell between the lines early in the spring of 1918. In order to save an aeroplane which had fallen between the British and German trenches, Lieutenant C. D. Fellowes twice crawled over 300 yards of open ground in full view of the enemy, started up the engine, and lying flat on the ground, allowed the machine to pass over him. He then ran after it and gained the pilot's seat. The machine left the ground, and as all the controls had been shot away he shut off the engine and drove it out of range of the enemy guns.

Of Second Lieutenant H. N. King it was officially reported that: "When a British aeroplane was forced down by enemy aircraft he jumped out of his advanced post and ran across No Man's Land with an N.C.O. to render assistance. He then signalled for stretcher-bearers and brought the pilot, who was seriously wounded, safely back to our lines. During all this time this officer and the three men who joined him were under heavy rifle fire, and one of the stretcher-bearers was shot dead on the way back. He displayed admirable promptitude and courage."

CHAPTER VIII

FINAL TRIUMPH OF THE FRENCH AIR SERVICE

War Growth of the French Air Services—Losses in the War—Aircraft Charges—The Home Front—Loss of a French Airship—German Raids on Paris—German Version—Spring Efforts—Brilliant French Aerial Defences—The Western Air Front—Fifty Tons of Bombs in one Day—Aircraft at the Marne—August French Aerial Activity—Photographic Missions—New Record—Co-operation with the Americans—Closing Stages—In the Death Throes—Harrying the Broken German Army—A Great Term Symbolised.

THE work of the French aviation service during the last year of the war provided an eminently suitable climax to an efficient, brilliant and daring effort.

From a wealth of splendid achievements, the work of the two greatest of the French "aces," Fonck and Nungesser, and their long and friendly duel for premier position stands out alone. At sea, the naval aviation corps was well at grips with the sinister German U-boat campaign. The enemy raids on Paris were fought, checked, and, finally, rendered impossible. Over the battlefields the activity of the French aviators increased by leaps and bounds, until, by the autumn, the German aircraft had been driven from the battle skies.

At the time of the armistice there were 19,219 officers and men in the two services—naval and military—as compared with roughly 1,000 at the outbreak of hostilities. Of this 1914 total 200 were in the naval flying service, which at that time possessed but eight machines which were undergoing trials. In four years, however, the naval service increased to 11,000 personnel, 1,364 aeroplanes and hydroplanes—of which 870 were on active service, and 257 dirigible and captive balloons.

Naturally, in such an effort, the number of casualties was high, even in proportion to the great amount of work under-

taken. Thus the French aviation losses in the army zones were:

1,945 pilots and observers killed;
1,461 missing, whose death was certain;
2,922 observers killed and wounded.

By May, 1918, the French Air Service was at the height of its power. Including two of the Gothas which raided the Paris area, French airmen and gunners placed to their credit 273 German aeroplanes and thirteen balloons. Of the aeroplanes, 139 were destroyed in fighting, nineteen fell to the gunners, and 129 were driven down seriously damaged. This French total compared with 150 German machines and eight balloons in March.

The previous month—April—the French had 138 enemy machines to their credit on the Western Front—69 destroyed, 59 driven down damaged, and 10 brought down by gunfire. In February 74 Germans stood to their credit—39 destroyed or captured and 35 driven down seriously damaged in the enemy lines, while in January the French claimed officially 81 German machines, of which 50 were crashed, 24 driven down damaged—of which a further 12 were probably destroyed—and 7 shot down by fire from the ground.

Aircraft Charges

Perhaps the most interesting development of French aviation at this period was the employment of massed aircraft—not unlike the old-fashioned cavalry charges—to swoop down low and attack the advancing German infantry. The first such aerial charge occurred late in March in connection with the American attack east of the Meuse.

When it became known that the Germans were massing between Damvillers and Warville for a counter-attack, 350 aeroplanes went up and dropped 32 tons of bombs on them. The attacking aircraft was made up of 200 bombing machines, 100 chasers, and fifty triplanes, arranged in nearly a dozen V-shaped formations. The German counter-attack melted away like snow, and twelve enemy machines encountered during the battle were brought down crashing to earth.

Final Triumph of the French Air Service

On May 30 an almost similar incident occurred on the French front. The officer in command of a French air squadron sent out some fifty machines against an enemy column which was occupying over three miles of a main road some little distance behind the German trenches. Like a cavalry charge almost, the aircraft swept in to the attack, ten or twenty yards above the level of the ground, a hail of machine-gun fire being poured on the column, and the aeroplanes only ceasing to harass it when it had been completely dispersed.

This new method of attack commended itself so much to the military commander that within two months some dozen similar aerial charges were made on advancing enemy infantry. The most successful of these attacks occurred with the routing of a German attack on a large scale on June 2. On being warned that considerable enemy preparations were being made, the commander of the sector, so as to avoid loss of life, instantly mobilised a group of day-bombing machines to the number of over 110, each of which carried thirty-two bombs.

Rising in successive squadrons to a height of 1,000 to 1,200 yards, the airmen threw tons of projectiles on the Germans, who were in close formation, with terrible results.

Enemy corpses were simply piled up, while those who escaped from the massacre took to flight mad with terror. The consequence was that the attack could not be launched for lack of assailants.

The Home Front

In the war behind the war, or, what may be termed the Home Front, the performances of the French airmen were equally creditable. Sea and land aviation figured almost equally in this the aerial home defence; and, though the antithesis of each other in their respective spheres of action, formed a wellnigh perfect combination in meeting German air raids. The activity of the various French naval air groups was very intense during the month of August. Aeroplanes and seaplanes flew a distance of 495,000 nautical miles, carrying out 4,288 patrols of a total duration of 8,595 hours. Naval airships made 286 flights, spending 1,924 hours in the air and covering 77,020 nautical miles. Altogether during the month of August 572,720

miles were covered in 4,574 patrols, as against 485,330 miles covered in 4,194 patrols in July. Captive balloons carried out 185 flights of a total duration of 3,346 hours. While one captive balloon remained for twenty-five consecutive days without being deflated, in tow of its trawler.

Loss of a French Airship

On the morning of February 20 previous the French naval air service had met with a severe reverse. That morning, following an accident with her rudder, a French dirigible collided with the cliff at Heve; a violent explosion followed, and Commandant Fleury, the captain of the dirigible, and another man were killed, while the quartermaster was thrown to the ground and had his right arm broken. Owing to the collision the bombs on board the dirigible exploded and wounded a number of persons who had arrived on the scene. The dirigible was entirely destroyed.

French airships and seaplanes, which in December recorded 3,000 hours of patrol work, achieved a record of 4,500 hours during January. In that month there were several cases of successful attacks by French aircraft on German submarines. In an entirely different theatre of operations—the Mediterranean—in May, a French seaplane on duty far off Gibraltar placed *hors de combat* the German submarine U39. The seaplane opened fire and dropped several bombs which scored hits. U39 immediately submerged and a little later was able, though with difficulty, to come to the surface. A few miles further on, in answer to the urgent wireless call of the aviators, a French patrolling submarine came along, and towed the disabled enemy craft into Cartagena, where it was promptly interned.

A yet more breathless incident is on record of two French naval airmen who were adrift in a disabled machine in mid-ocean for over twelve days before being picked up. For their fortitude Sub-Lieutenant Langlait was awarded the Legion of Honour and Boatswain Dien the Médaille Militaire. It appears that when over 500 miles away from its station, the machine had to come down through engine trouble. They were well off the track of patrol boats, and drifted about on the sea surface for twelve days. After using up their two days' rations they

THE WORK OF THE FRENCH AIR SERVICE

These fine pictures show two phases of the work of the French pilots. Above we have the result of a combat above the clouds and the sea between a German seaplane and a French aeroplane. The lower picture shows a group of double-engine Caudron biplanes bombing the city of Karlsruhe,

ate two of the carrier pigeons they had with them, and when they had used the fresh water out of the radiators they filled up a rough still and boiled sea-water to make it drinkable.

It is somewhat curious to note, turning to the other arm of home defence, that the Germans should choose the closing months of the war to reintroduce an aviation policy which had already proved beyond all question disastrous—to carry out a series of intensive bombing raids on the French capital. Some dozen such attempts were made during the first six months of 1918. Thirty-six people were killed—22 in Paris, 14 in the suburbs—and 190 injured as a result of an aerial attack on January 31.

Four enemy air squadrons crossed the lines north of Compiègne, and reached Paris, flying at a very great altitude, and favoured by the clearness of the atmosphere. They approached Paris and its suburbs from the north and north-east, dropping in succession bombs on several suburbs. They then flew over Paris, chiefly on the right bank of the Seine, where, in a few moments, they dropped almost all their bombs, causing a fairly considerable number of casualties, especially among women and children. Two hospitals were hit and several buildings burned and damaged. Several air fights were fought north of the capital. One German aeroplane was brought down and its two occupants taken prisoners, while one French aeroplane had to land, its occupants being wounded.

The raid on Paris on the evening of March 8 appears to have been carried out with considerable forces. A message from Paris the same day speaks of from ten to twelve squadrons following one another, advancing on Paris along the Oise and Marne valleys and Creil-Paris railway line.

As soon as the alarm signal had been given, a violent barrage was opened from all the posts in the north and north-east, and was kept up uninterruptedly until the alarm was over. About sixty aeroplanes went up for the defence. A number of enemy aeroplanes were driven back before they could reach Paris. Several bombs were dropped on uninhabited land in the suburbs. While the raid was taking place French aircraft at the front bombarded the enemy's base aerodromes, notably Ville aux Bois and Epreux. One enemy was shot down—a Friedrich-

shafen of 80-feet span, with two 250-h.p. engines, and camouflaged in black—being found in the forest of Compiègne with its four occupants burnt to cinders. The raid commenced at 8.45 P.M. and lasted nearly three and a half hours. The casualties were officially reported as: Paris, 7 killed (3 men, 4 women), 26 injured (16 men, 7 women, 3 children). Suburbs, 4 killed (3 men, 1 child), 15 injured (7 men, 7 women, 1 child).

A few bombs fell in the district of Seine-et-Oise, where two people were killed and nine injured.

German Version

The following day, March 9, it was officially announced from Berlin that: "As reprisals for the dropped bombs by the enemy on the open towns of Trier, Mannheim, and Pirmasens, on February 19th and 20th, our aeroplanes again attacked Paris with bombs during the night of March 8-9 with great effect"; and, on the 12th of that month, that: "In retaliation for the enemy aerial attacks on March 9 and 10 on Stuttgart, Esslingen, Unter Turkheim, and Mainz, our airmen last night copiously and successfully bombed Paris."

What actually happened was that at about 9.10 P.M. some sixty aeroplanes succeeded in crossing the lines. Thanks, however, to the French artillery barrages, which were maintained throughout the entire raid with great intensity, a certain number of machines were unable to reach their objectives. Nevertheless, numerous bombs were thrown on Paris and its suburbs. Several buildings were demolished or set on fire.

The following casualties were reported: Paris, 29 killed, 50 injured. Suburbs, 5 killed, 29 injured.

In addition, 66 persons, mostly women and children, were asphyxiated in the crowd during a panic which occurred at the entrance to a refuge in the Metropolitan Railway.

One of the three Gothas brought down was reduced to ashes by fire, and the pilot and other occupants were burned to death. Most of the crews of the other machines brought down were wounded.

It was announced afterwards officially that the casualties in the panic at the Metropolitan Railway station in Paris during the air raid on March 11 were 70 killed and 71 injured.

Final Triumph of the French Air Service

The Municipal Council of Paris decided to give assistance to families stricken in air raids, and to grant perpetual concessions for their burial. The Government also decided that a special detachment of military should attend the funeral of each victim, and that the coffins should be covered with a tricolour pall.

Two more German air raids were made on the French capital before the end of the month.

At 10.20 P.M. on March 22 a group of enemy aeroplanes crossed the French lines. A certain number of bombs were dropped on Compiègne and various towns in the district. Some of the aeroplanes pushed farther south, but had to beat a retreat owing to the strong anti-aircraft fire. The alarm was also given in Paris, but half an hour later the "All clear" was sounded.

At 8.30 A.M. on March 23 a few German aeroplanes, flying at a very great height, succeeded in crossing the line and attacking Paris. They were immediately engaged by aeroplanes both of the Paris defences and of the front. Several bombs were reported to have fallen, while there were some casualties.

At 8.42 P.M. the same day German aeroplanes crossed the French lines and bombarded several places at the rear of the front, but did not reach the Paris region.

Spring Efforts

There occurred another similar raid in April and May. A number of German aeroplanes on the night of April 12 crossed the French lines in a southerly direction. Before reaching Paris, however, one of the enemy craft—a Gotha—was brought down in the neighbourhood of Compiègne. Actually only two of them succeeded in flying over the Paris district, where they dropped a few bombs. Twenty-six persons were killed and seventy-two were injured. A considerable amount of material damage was done. Where the bombs fell not a pane of glass was left for a considerable distance, and the roads were blocked with debris and trees which had been torn out by the roots. One bomb made a hole 10 feet deep and 6 feet wide. The next day large crowds visited the damaged districts, which

had been barricaded off by the police. The warning was given at 10.10 P.M., and the "All clear" at 10.40.

Almost at the time of crossing the firing-lines the unfortunate Gotha had been seen to send out a red flare, and immediately afterwards it dropped its bombs. Then it descended rapidly and capsized on striking the tree tops. The forest was searched later, and four dead bodies were found lying among the bracken. The pilot was a lieutenant decorated with the Iron Cross, the bomber was a captain, and the machine-gunner was a lieutenant. The mechanic had in his haversack a number of proclamations intended for Paris. The Gotha measured nearly 80 feet from tip to tip, and was armed with three machine guns and five bomb-carriers.

Brilliant French Aerial Defences

Though many further attempts on the part of German aircraft to raid Paris were made before the signing of the Armistice, it is worthy of note that on no single occasion did they prove really successful. The French aerial defence by this time was almost invincible.

In the short space of two days—May 15 and 16—the French repulsed no less than three determined aerial attacks on the capital. On the 15th an alarm was given towards midday in the district north-east of Paris. An enemy aeroplane was making for the capital, but the defence batteries immediately came into action, and French airmen went in pursuit of the German, who changed his direction and fled without dropping bombs. The "All clear" was sounded forty-five minutes later.

The second alarm was late in the evening. On the observation posts of the fortified zone of Paris notifying that enemy aircraft were making for Paris, the alarm was sounded at 10.12 P.M. Fire was opened by the artillery posts, and the aircraft assigned to the defence of the city took to the air. No enemy machine succeeded in reaching Paris, but several bombs were dropped in a large suburb. The "All clear" signal was given at 11.55 P.M.

A fresh air-raid alarm was given in Paris at 1.50 A.M. The "All clear" was given at 2.30.

Final Triumph of the French Air Service

It was unofficially reported that two successive attempts were made by two different groups of German aeroplanes. The first group, having dropped bombs about nineteen miles south of the point at which they had crossed the lines, returned at about 11 o'clock. A second group of four aeroplanes, crossing the lines a few minutes later at almost the same point, made for the south-west, but had to return after having gone about thirty miles. They dropped a few bombs in open fields.

On the night of June 26 German aeroplanes again attempted to raid Paris. They attacked in several groups, but only a few bombs were dropped. There were no casualties. The alarm was given at 11.16 P.M., and the "All clear" at 12.35 A.M.

The following night another attempt was made. The attack lasted from 10.30 P.M. until 12.5 A.M., and it was rather more violent than its predecessors, though, fortunately, the death roll was comparatively small. Eleven people were killed and 14 were injured. Most of the casualties were among people who were walking in the streets. Some material damage was done.

One Gotha was brought down by anti-aircraft guns in the Forêt de Largue, north of Compiègne, one of the crew being killed, while the other two were taken prisoners.

A third consecutive visit was paid on the night of June 28, when the raiders were met by a very violent barrage. A few bombs were dropped, but little damage was done and there were no casualties. The alarm was given at 11.39 P.M., and the "All clear" at 12.30 A.M.

On the night of June 30—July 1 there was a double alarm, the first from 11.58 to 12.20 and the second from 12.48 to 2.20. In the second attempt a few bombs were dropped in outlying districts, but no casualties were reported.

While an official report, issued in Paris on July 2, stated that the previous night enemy aeroplanes crossed the lines and made for Greater Paris. They, however, were turned back before reaching the capital, and there was nothing to report. The "Alert" was sounded at 12.34, and the "All clear" at 12.59.

The Western Air Front

Whether it were in bombing or in battle, reconnaissance, artillery direction, or aerial attacks on enemy infantry from low altitudes, in these closing stages of the war there was tremendous activity recorded in every branch of the French Air Service. One day it would be reported that "the railway stations behind the front were pelted with projectiles," or "assemblies of [German] troops were attacked with machine guns and bombs and broken up," or, as it was announced on August 23, "our observation machines did a considerable amount of work during the battle, in spite of atmospheric conditions which were often unfavourable, and notwithstanding the attacks of enemy airmen who endeavoured especially to prevent our infantry aeroplanes from carrying out their reconnaissances"; and on another day it would be "numerous shots on objectives and fires were observed," or, as in the battle on the slopes of the Avre, "notwithstanding the unfavourable weather and low clouds, our pilots were very active," or "our airmen repeatedly caught retreating German troops under machine-gun fire," or "nineteen enemy machines were brought down and were seen to fall out of control, and three balloons were set on fire," or, again, "the favourable conditions enabled the Air Service to effect important work."

Fifty Tons of Bombs in One Day

During the month of June the French Air Service brought down no fewer than 150 German machines, and seriously damaged 181. In addition, 31 enemy captive balloons were brought down in flames. Bombing machines dropped over 600 tons of bombs. During the day and the night of the 27th alone 58 tons of bombs were dropped on aerodromes on the Somme and in the region of the Aisne, on cantonments and bivouacs at Rozières-en-Santerre, Fismes, and Guignicourt, and the railway stations of Soissons and Fère-en-Tardenois.

One hundred and eighty-four German aeroplanes were brought down by French aviators during the month of July, 30 by anti-aircraft guns, while 154 enemy aeroplanes were seen falling out of control in the enemy lines, 15 of them hit by the fire of the French anti-aircraft guns. In addition to this total

of 338 German machines which were destroyed or seriously damaged, French aeroplanes also set fire to 49 hostile captive balloons.

During the same month the French day bombarding squadrons dropped 194 tons of bombs and the night squadrons 356 tons, or 550 tons altogether, on the bridges in the Marne Valley, enemy troops which had advanced south of the Aisne, and the railway stations in the region of Laon, Hirsin, and Rethel.

One particular aerial incident which occurred during July is worthy of repetition in these pages. It happened during the great advance, and was not unlike a new story of Elijah in a modern war setting. On the 21st of the month a French battalion engaged near Pourcy, between the Marne and Rheims, was isolated by the enemy. The Frenchmen fought on steadily, and, it being impossible to send provisions by road, it was decided to send them by aeroplane.

Accordingly a number of aeroplanes were sent out, carrying 200 big loaves, numerous sacks of biscuit, and 250 tins of bully beef, all of which were dropped within the lines of the besieged battalion.

Next day, their ammunition having run out, supplies were renewed from the air in the same way. Thanks to the enterprise of the airmen, the battalion was able to hold out till relieved the following night.

Aircraft at the Marne

The general aircraft operations embraced co-operation with the infantry in the great battle of the Marne. On the 16th of July it was reported officially that "our Air Service has taken an important part in the battle engaged on the front of the Marne and Champagne. In spite of unfavourable atmospheric conditions, our observers did not cease to fly over the German lines during the days preceding the attack. Thanks to their sustained vigilance, they managed to furnish valuable information with regard to the offensive, and to indicate its extent. During the first hours of the battle our airmen intervened actively, notably on the Marne. In spite of the thick curtains of smoke which hid the bridges thrown across by the enemy, our crews discovered them, and attacked them, flying

at a low altitude. They succeeded in destroying by bombs two of these bridges loaded with troops, who were hurled into the river, while attacks with machine guns and bombs were showered on convoys and columns debouching on the north bank. Tons of projectiles were used in this way during the day at various points of the front with complete success, and the attacks were continued during the night. No less than 14 tons of projectiles were dropped on the enemy's bivouacs and points of assembly and concentration, causing several fires and much damage. Our airmen, in addition, fought a hard battle against the enemy's air service, and obtained good results. Forty-one enemy aeroplanes were shot down or driven out of control, and nine captive balloons were set on fire. In less than five minutes Sous-Lieutenant Bourjade personally destroyed three of these balloons. Lastly, the aerial observation service did not cease to mark the position of our troops, and especially that of the enemy, and to direct our artillery fire with great effect. Sous-Lieutenant Haegelin shot down his tenth machine on July 10. Up to that date he counted to his credit four captive balloons and six aeroplanes, officially confirmed."

"Our Aviation Service continued to play a brilliant part in the battle," it was announced on the 18th. "On the 16th our bombing crews did not cease to attack the Marne bridges and to hamper the passage of the enemy troops. The latter, attacked by machine gun and bomb at the moment when they were debouching on the northern and southern banks, suffered heavy losses, and were compelled to scatter on several occasions. The bridge thrown by the enemy in front of Dormans was subjected to a flood of projectiles and collapsed. The convoys which were crossing it were engulfed in the river. Our bombers also carried out expeditions against the cantonments, stations, munition depots, and concentration points behind the enemy front. Twenty-one tons of explosives were dropped in the daytime and 14 tons during the night. Our observers noted great damage at various points, a violent explosion at the station of Maison Bleue, and fires in the stations of Coucy, Les Etapes, and Buzoches. Our aeroplanes, with their customary intrepidity, fought numerous combats above the enemy lines. Twenty-nine German machines were felled

or disabled, and five captive balloons were set on fire. On the 17th, notwithstanding a violent wind and torrential showers, our crews took the air and obtained good results. Twelve German aeroplanes were felled and four captive balloons destroyed. During attacks on the Marne crossings about 58 tons of explosives were employed."

August French Aerial Activity

The following month, August, ushered in the grim, bloody battle on the slopes of the river Avre. The French airmen were kept incessantly busy. They took part in the battle in intimate touch with the infantry, marking the advance and harassing the enemy with bombs and machine guns. Despite rather unfavourable atmospheric conditions, the French squadrons engaged in numerous combats, in the course of which fourteen German machines were brought down or fell out of control. Nine captive balloons were set on fire. French day bombarding formations dropped over 23 tons of bombs on troops and concentrations in the valley of the Avre and in the battle zone, as well as on the stations behind the front, while the night bombarding air service dropped nearly 17 tons of bombs on the stations of Ham, Tergnier, Nesle, Hombleux, and on numerous bivouacs, causing fires and explosions."

During the day of August 11, notwithstanding the enemy aircraft which attempted to oppose the passage of the French aerial forces, bombing squadrons carried out successful expeditions over the enemy's lines. Concentration centres, important junctions, bridges, cross-roads, and railways were copiously drenched with bombs, and columns on the march were machine-gunned. Seventeen tons of bombs were dropped on the important centre of communication of Porquericourt in broad daylight, and numerous convoys were blocked. A total of 57 tons of projectiles were dropped, including 22 tons during the night-time in the districts of Ham, Guiscard, Tergnier, etc. The same day 15 enemy machines and four captive balloons were brought down, whilst 21 were put out of action by French pilots in conjunction with American crews.

Favourable weather on the 22nd enabled French pilots to carry out important work. The observers made numerous

reconnaissances far into the German lines. In particular, the photographic mission brought back more than a thousand exposures from their expeditions. The chasing planes felled or put out of action 14 enemy aeroplanes, and set fire to nine captive balloons. The day bombing squadrons dropped 18 tons of projectiles and fired thousands of cartridges on concentrations of troops and convoys in the Margival ravine, on the roads from Soissons to Chauny, and on Vauxaillon, Anizy-le-Château, and Laffaux. During the night the French aerial activity in no way relaxed. Twenty-five tons of bombs were dropped on the stations of Ham, Laon, and Anizy-le-Château, causing fires, particularly at Chauny and at Guiscard, and blowing up a munitions depot at Somettes Eaucourt. The stations of Mézières, Maison Bleue, Machault, and Pontabert were also bombed with excellent results. Finally, a raid in great force was carried out against the very important aerodrome of Mars-la-Tour. As soon as the first bombs fell, a great fire broke out in the aeroplane sheds and the huts of the staff. Aided by the light of the flames, the other aeroplanes were able most effectively to bomb the other hangars and huts, and also the personnel. Numerous machines were seen to be burning on the ground. Altogether, 43 tons were employed in the daytime and during the night.

During the month of August French day bombers dropped over 269 tons of bombs on objectives on the battlefield between the Somme and the Aisne. Attacking the railway stations and the German ways of communication, the night bombers dropped over 262 tons of missiles; while during the same month French aviators brought, or forced, down 280 German aeroplanes, including 29 accounted for by anti-aircraft guns, and 66 enemy captive balloons were set on fire.

The French aerial activity in September, 1918, was unequalled at any other period of the war. On certain days more was accomplished within the space of twenty-four hours than in the whole of September, 1914, or one week of September, 1916. The month opened with a storm of driving rain and clouds. Nevertheless, four German machines were shot down and one captive balloon set on fire. French reconnoitring aeroplanes, in the course of their expeditions, carried out several

bombardments in the region of La Fère. Convoys on the road system round St. Quentin and La Fère were machine-gunned. During the night nearly 10 tons of bombs were dropped on railway stations, and in particular on those of Marles, Laon, and Ham, causing fires. In addition, 8 tons of projectiles were dropped on the bivouacs in the region of Villers-Franqueux and on the railway stations of Maison Bleue and Guignicourt. On the latter railway station alone 4½ tons of projectiles were dropped, causing heavy damage.

During the following day (September 2), favoured by the fine weather, the French Air Service displayed particular activity on the whole front and carried out important work. The observers made numerous reconnoitring expeditions over the enemy's lines and took some hundreds of photographs. In the battle zone infantry aeroplanes marked the advance of the French troops, located the enemy's forces and batteries in action, and in conjunction with the artillery co-operated in the destruction of the enemy's centres of resistance. Very many fights took place, in the course of which nineteen enemy aeroplanes were shot down or put out of action and nine captive balloons set on fire in particularly perilous conditions. The bombing aeroplanes, in the course of expeditions carried out during the day, dropped over 13 tons of bombs on the regions of Chavignon, Anizy-le-Château, and Brancourt. During the night, in spite of cloudy weather, they continued their work. Sixteen tons of projectiles were dropped on the railway stations, bivouacs, and railways in the enemy's back areas. The railway station at Flavy-le-Martel alone received 6 tons. Two violent fires broke out as the result of this bombardment. Three tons dropped on the cantonments of the region of Jussy and 4 tons on the railway stations of Guignicourt and Maison Bleue gave excellent results. In addition the bombers used several thousand rounds on the enemy's bivouacs.

Co-operating in the offensive actions of the American Army on the 12th and the 13th, an almost equal degree of aerial activity was achieved. In spite of a violent wind, low clouds and rain, the bombing and chasing machines attacked troops and convoys in the region of Conflans, Chambley, Vigneulles, Hattonchatel, and Mars-la-Tour. Seven enemy machines were

brought down or put out of action, and one captive balloon was brought down in flames. In addition, the French observation aeroplanes did not cease, in spite of all difficulties, their task of informing the Command as to the situation of the battle-field and as to the progress of their troops supporting the American units.

On the 15th, in conjunction with the American Army and on the French front, 14 enemy aeroplanes were brought down or driven down out of control and 7 balloons were set on fire. Six and a half tons of bombs were dropped during the day on enemy assemblies. During the night bombarding squadrons dropped more than 23 tons of projectiles on the stations of Laon, Mortiers, Juniville, Conflans, Mars-la-Tour, etc.

That same day on other parts of the front the French Air Service, favoured by the fine weather, was extremely active. The airmen, directing their efforts to impeding the enemy's observation work, obtained remarkable results. In spite of the powerful protective measures undertaken in order to defend observation balloons, 16 captive balloons were brought down in flames. In addition numerous air fights took place, in the course of which 12 German machines were brought down.

The bombarding air-service during the night of September 15-16 made expeditions against the lines of communication, the stations, and cantonments behind the enemy's lines. The railway stations of Laon, Amagne, Marle, Longuyon, Dommary-Baroncourt, and Conflans were freely bombed and suffered important damage. Fires and explosions were observed, especially at Marle and Longuyon. A total of 46 tons of bombs were dropped.

The following day six enemy machines were brought down or driven down out of control, and one captive balloon was brought down in flames, while the night-bombing service carried on its work despite the tempest and rain which were raging. More than 10 tons of bombs were dropped on hostile railway stations, bivouacs, and aerodromes. Several fires were observed.

During Friday, September 21, activity was slight owing to the unfavourable weather. It cleared up during the night, when the bombarding airmen dropped nearly 18 tons of bombs

on enemy aerodromes, particularly on the night bombarding squadrons and on the junctions of important railway lines. Particularly successful results were observed, notably on the aerodromes of Stenay and Marville, where fires broke out, and on the railway stations of Etain, Juzancourt, and Juniville, where fires and explosions were noted. Sous-Lieutenant Ambrogi brought down in flames on September 15 and 16 two captive balloons, which brought up to eleven the number of aircraft brought down by this pilot.

Closing Stages

So the French aerial activity increased daily more and more until the cessation of hostilities. During the daytime of September 26 the fine weather enabled the Air Service to employ all the means at its disposal to co-operate in the battle. By means of numerous reconnaissances and pushes far behind the German lines, and by the many photographs secured, the reconnoitring patrols kept French Headquarters effectively informed of all movements of enemy troops and convoys, as also of the activity on his principal lines of railway. The bombers, profiting by the information thus secured, dropped during the daytime 26 tons of projectiles in the rear zone of the battle and in particular on the crossings of the Alin (north of Tahure) and in the region of Somme-Puy. During the night the work of the bombers continued with equal vigour. A total of 23½ tons of bombs was dropped on enemy cantonments and bivouacs in the rear of the front, on enemy aviation grounds and railway stations, and particularly on those of Laon, Longuyon, Le Catelet, and Amagne. Several fires occurred as a result of these bombardments. Finally, the fighting planes, by their vigorous action, rendered observation on the part of the enemy air service almost impossible, and achieved very great success. Forty-two enemy machines were brought down or put out of action, and seven captive balloons were set on fire in the course of the day.

A fortnight later, during the day of October 10, French bombing aviators, working in conjunction with advanced elements of the French infantry, carried out important operations, dropping over 35,000 kilogrammes of projectiles on con-

centrations of troops and convoys in the region of Vouziers and on a munitions depot, which exploded. Numerous fights in the air took place, in the course of which seventeen enemy aeroplanes were brought down or fell disabled. Eight balloons were set on fire. The observing machines incessantly flew over the rear of the enemy front, reporting particularly numerous fires which the enemy was kindling during his retreat. During the night the bombing squadrons continued their activity of the daytime, dropping 24,000 kilogrammes (24 tons) of explosives on bivouacs in the region of Laon, the stations of Longuyon, Hirson, Attigny, Pauvres, Montcornet, and on the convoys and trains in the Montcornet-Rethel region. Numerous hits were observed, and fires and explosions were caused, especially in the stations of Hirson and Attigny.

Meanwhile, during the month of September, French airmen had driven or brought down out of control 211 German machines, of which only eight fell in the French lines, most of the fights having taken place over the retreating German Army. During the same period sixty-two kite-balloons were set on fire, and the bombing squadrons dropped 369,000 kilogrammes of projectiles, or 156,200 kilogrammes in the daytime and 213,000 during the night.

In the Death Throes

Perhaps no factor influenced to such a degree the irresistible French advance immediately before the Armistice as the spell of unprecedented aerial activity between October 28 and November 1. "The work of our aviation service," it was reported from Paris on October 28, "was continued to-day very actively, although dense fog rendered its task particularly difficult. Our observation machines effected numerous reconnaissances on the whole of the region behind the enemy's front and brought back valuable information for the Command and numerous photographs. They have particularly reported fires in the greater part of the localities on the right bank of the Aisne, which is still in the enemy's hands, as well as in the valley of the Serre between Marle and Montcornet. Our bombers, protected by fighting machines, carried out, with an audacity which had its full effect, several expeditions in the

region of Seraincourt. This village, at the junction of several roads, has played an important role in supplying the enemy in the battle waged by the Fifth Army between Sissonne and Château-Porcien. One hundred and twenty bombing and eighty chaser aeroplanes undertook in successive groups an attack on the objectives designated, notably supply convoys, munition depots, and encampments in the region, as well as on troops which had been signalled in the ravine south of Seraincourt. Thirty-three tons of bombs and 15,000 bullets were fired, causing serious losses to the enemy and great disorder in his ranks, and at certain points the complete stoppage of traffic. In addition several fires and the explosion of a munitions depot were observed. In the course of the day's operations nine hostile aeroplanes were brought down and a captive balloon was set on fire. The fog, which became absolutely dense, completely stopped work during the night. Sous-Lieut. Marinovitch brought down his twentieth machine and Sergt.-Maj. Mace his tenth.

The following day it was reported that: "On October 28 fine weather favoured the flights of our airmen, who carried out important work. Nine enemy aeroplanes were shot down or fell out of control in the course of fighting, and a balloon was set on fire by one of our crews.

"During the night, in spite of the poor visibility, our bombers dropped 16 tons of projectiles on the main railway stations and important assembly points, in particular on the railway stations of Hirson, Vervins, St. Gobert, Montcornet, Marle, and Audun-le-Roman, on the aviation ground of Mars-la-Tour, and on the vast depots of Previsy. A number of conflagrations were started, notably at Previsy, Hirson, and Marle."

Harrying the Broken German Army

The very fine weather on October 29 enabled the French airmen to give full development to their activity. Observation aeroplanes traversed the enemy's back areas in every direction in their reconnaissances, some of which were pushed as much as fifty miles, and one of which penetrated as far as seventy-five miles, into the zone occupied by the Germans. The bombing

planes, continuing their action of the preceding days, dropped over 37 tons of explosives and fired 20,000 rounds on the points of assembly and convoys of the enemy in the region of Remaucourt and Seraincourt (both east of Laon). In the course of these operations and of flights undertaken by fighting planes, twenty enemy machines were shot down or fell out of control and three captive balloons were set on fire. During the night the bombers attacked the most important railway stations of the enemy. Nearly 19 tons of projectiles were used with the most successful results on the junctions of Givet, Mézières, Hirson, Vervins, Montcornet, and Launois, and on the depots and bivouacs of the region of Previsy and in that of Montcornet. Adjudant Pezon on October 29 set fire to an enemy balloon, this being the tenth machine accounted for by this pilot—nine balloons and one aeroplane.

In the favourable spell of weather of the 30th many fires were reported by the scouting pilots in the Marle-Montcornet region. Mist and cloud on the 31st hampered aviation operations, nevertheless a number of reconnaissances were made, and the French chasers brought down five German machines.

Atmospheric conditions were even more unfavourable during the night that followed, yet French airmen were able to drop a ton and a half of bombs on the railway stations of Longuyon and Dommary-Baroncourt. From Paris it was reported: "On November 1st the very dense fog along the whole front hindered aerial operations. However, our Air Service, acting in co-operation with our troops, gave them valuable aid in the regions of the front where they were attacking, as well as in Flanders before the Fourth Army. Observation aeroplanes, incessantly flying over the enemy lines under the protection of our chaser machines, marked the advance of our infantry, regulated the artillery fire on its objectives on the battlefield, and carried out very many reconnaissance flights in the enemy's back areas. Two of these flights, which went as far as 120 kilometres behind the enemy's lines, enabled the province of Namur to be explored. At the same time great activity by troops and convoys having been noted in the rear of the front of attack of the French Fourth Army and the American Army in the region of Chesne Tannay

and Noirval, several bombing expeditions were at once carried out there; 148 bombing machines in successive groups, protected by fighting aeroplanes—120 in number—took part in these expeditions. The French bombers were able to drop from a low height under the best conditions 39,600 kilogrammes of bombs, and to fire tens of thousand of bullets, spreading panic among the hostile troops and dispersing, not without inflicting on them heavy losses, convoys and important concentrations of soldiers. In the course of these operations seventeen enemy machines were brought down or put out of action, and one captive balloon was brought down out of control. During the night, despite a very thick fog, 20,850 kilogrammes were also dropped by the French bombers on the enemy's most active stations, especially on those of Vervins, Montcornet, Hirson, Mézières, Poix, Terron, and Wassigny."

Personality, perhaps even more than in any other individual air service, played a great part in these French aerial victories. To stand out as an individual, to evolve a novel plan of aerial combat, to go out roaming the skies on an independent mission, was the ultimate aim of every French aviator of note and otherwise. Indeed, it was with the French that the word "ace" originated. Originally the word was intended to signify a great fellow: one who had done things of note in his life. As he watched the daring airman battling in mid-air over the trenches in the early stages of the war, the *poilu* acquired the habit of referring to every French aviator of renown as an "ace." The word was adopted officially by the French authorities in 1916, as signifying an aviator who had brought down five or more enemy machines, and Guynemer became the first of the French "aces."

A Great Term Symbolised

In due course, thus, that small word came to symbolise the finest phase of the war history of France. Fonck and Nungesser only have to be mentioned as splendid examples, following that modern Bayard of the air, *sans peur et sans reproche,* Guynemer. Guynemer, who, with all the invincible spirit and gaiety of youth amidst the bloody things of war, could say of his first great victory: "I had had the luck to send elegantly

to the ground a Fokker that I will not count, because it was so far away in the enemy lines"!

"Next day," this irrepressible youth continues, "I set out after dinner time. I have a particularly affectionate regard for this hour, for the Boche cherishes a delusion that at this time we Frenchmen only eat and sip our coffee, profiting by this opportunity to inflict his odious self upon us.

"I was not long in seeking fortune. A Boche appears before me, and hardly accepts the combat. Poor type! At 11.23, after two cartridges only, he descended, exploded, pulverised, burnt, inside our lines, 300 metres from Roye. '*Œuf à la coque Guynemer:* Put an egg in boiling water when your ace accepts combat, wait till he has killed his Boche, withdraw your egg, it will be done to a turn.' What a triumph for the restaurant ménus!

"If you wish, I will guarantee you that the three minutes are absolutely chronometric. But list, and I will tell you how I was nearly dished myself. Looking out over the immensity of the azure that I had cleansed, in the hope that other amateurs might present themselves, when suddenly, thirty seconds after, a shell from a French 75 lashes through one of my wings. My *avion* seems wounded as to death, the left wing entirely ripped. The linen snaps in the wind, tearing more as the fall prolongs. My machine falls, founders, rolls in the abyss, incapable of supporting me. Truly I hear the call of death, towards whom I seem to hasten vertiginously. Nothing, it seems, can hinder my being crushed on the earth. A frightful *vrille* commences at 3,000 metres, and continues until 1,600, and I feel lost. I demand only of Providence not to let me fall on enemy territory. *Ça jamais!* They would have been too pleased. Do you see me interred with my victim? But I could not assert my will: the machine obeyed not. At 1,600 still I struggle, the wind having thrust me as far as our lines. I am already half happy. I think now of an interment with the sympathetic comrades following my remnants.

"At least no pointed helmets shall defile me! I feel none the less that it is death, and not agreeable. The fall continues. The controls do not answer. Twist to right, to

left, push, pull, no result: the meteorite will not arrest itself. Invincibly I am drawn towards the soil, where I shall be crushed!

"Here it is! A last gesture—brutal, but in vain. I shut my eyes. I see the earth which, at 180 kilometres an hour, rushes to annihilate me! A rending crash, a strong emotion! Of my Spad there remains nothing. How am I still living? It is my safety belt that has saved me, encrusted in my shoulders. Without it I should be dead at this hour, *moi qui vous parle.*"

"It is easier to bring the Boches down than to describe how it is done," Fonck once remarked characteristically enough to a newspaper representative who was interviewing him with regard to his record feat of vanquishing six German airmen in one day.

Fonck, a young man of twenty-three years of age, laid claim to the greatest total of victories—75 officially, unofficially 140—of any Allied airman in the war. Serving with the British in Flanders, for his valuable co-operation he was awarded the Military Cross and the Distinguished Service Medal. In recognition of his great work that May day of 1918 the Cross of an Officer of the Legion of Honour was conferred upon him. Yet he admits, "I only started as a pupil at the end of April, 1917. Six days later I got the first of my Germans as a chasing pilot. Of course ever since the beginning of the war I was in the aviation service, but my first job was to be an observer. I saw those six enemy machines before they noticed me, and manœuvred for position."

Of the six, four were two-seater planes, each carrying two machine guns; the other two were fighting planes, each mounted by a single pilot. Fonck deprived the German Army in twenty-four hours of ten highly trained airmen.

He first succeeded in getting above the German machines, and opened fire with his machine gun at short range. Within a few seconds the first two German machines, each manned by two men with two machine guns capable of firing at any angle, were hurtling downwards to destruction. The third machine attempted to bolt, but he was too quick for it and sent it crashing on fire.

The fight had lasted less than ten minutes. It was Fonck's work for the morning.

In the afternoon he went out on his second patrol. Flying over the enemy's lines in the region of Montdidier, he encountered a patrol of nine German machines. He chose his time and attacked. He brought down three machines, one double-seater and two chasing planes. The rest bolted for safety.

Fonck believed in group formation for fighting as opposed to the original methods of flying as an attacker single-handed, such as had been practised by Pegoud, Garros, Gilbert, Navarre, and even Guynemer and Nungesser. "The Germans," he said, "when they inaugurated group flying, taught us and unfortunately made us pay dearly for the lesson of the dangers attending an effete method. But I am by no means a partisan of flying in over-big groups like that of the 'Richthofen Circus.' I generally fly with two comrades"—a group of three —"and I am inclined to favour several groups of three sufficiently distant not to hinder each other's preparations, but also sufficiently near to understand one another and give help at crucial moments. Too big a number may easily prove a peril, especially against a clever and daring enemy capable of practising the only tactics suited to the occasion, which is to throw himself into the middle of the group, paralysing thus his adversaries, who can neither manœuvre nor fire for fear of injuring each other, whilst he, on the contrary, retains every facility of action."

CHAPTER IX

THE SQUADRON

The Squadron—Empire Squadrons—General Utility Squadrons—The Tank-plane Squadron—No. 74 Squadron—Reprisals Squadron—Wasted Hun Fury—Formation of the Independent Force—The C.I.B.—How the R.A.F. found its Targets—Low Strafing—Strafing a Marching Column—The Eyes of the Canadian Corps—The Battle of Amiens—Work in the Arras-Cambrai Advance—Canadians in the Last Phase.

THROUGHOUT the war the squadron was the tactical unit of the aviation services. Squadrons were devoted to every branch of aerial warfare from photography to combat, from night bombing to anti-submarine patrols. A comparison between the first and the last year of the war will reveal a development in numbers of squadrons that is almost incredible.

SQUADRONS MAINTAINED

SERVICE

	August, 1914	*October*, 1918
Western Front	4 (R.F.C.)	84 and 5 flights.
Independent Force	—	10
5 Group	—	3
India	—	2
Italy	—	4
Middle East	—	13
Russia	—	½
Home Defence	—	18
Naval units	1 (R.N.A.S.)	64

TRAINING

(1 Training Depot Station reckoned as 3 Squadrons)

	August, 1914	*October*, 1918
Home	1 (R.F.C.) 2 (R.N.A.S.)	174
Egypt	—	10
Canada	—	15

Perhaps the most interesting and illustrative of these squadrons was No. 55, of which we shall have more to say later. Meanwhile, we shall deal with the manifold uses to which these various squadrons, each of which possessed an individual number, were put. In February, 1916, for instance, when the responsibility for home defence of the British Isles was taken over from the Admiralty by the War Office, No. 19 Training Squadron, in addition to its training duties, was entrusted with the defence of London against enemy aircraft attacks.

Empire Squadrons

No. 39, the first actual home defence squadron, was formed in May, 1916, and by the end of the year one night training squadron and ten other home defence squadrons had been formed and distributed throughout England. Almost every British Dominion, with the exception of Canada, was represented by its own flying squadron—Canada supplying a total of 1,239 officers to the R.N.A.S., R.F.C. and R.A.F.

The inauguration of the Australian Flying Corps in 1915 was the result of an offer by the Australian Government to form a flying unit for co-operation with the British Indian forces in Mesopotamia. Four flying officers and sixty other ranks arrived at Basra in May, 1915, and took part in the Kut operations. The first complete Australian squadron left Australia for Egypt in March, 1916, and later played an important part in the work of the 40th Wing in the Middle East Brigade. Three additional squadrons were organised for service in France, the first arriving there in August, 1917; these were responsible for the destruction of over 400 enemy machines between that time and the signing of the Armistice. Further, four training squadrons were formed in England in which most of the Australian pilots were trained, the entire personnel being drawn from Australia or from the Australian Imperial Forces in France. Some months before the end of the war a central flying school was established in Melbourne, and the aeroplane industry itself was also definitely established in Australia about the same time.

The strength of the Australian Flying Corps in November,

1918, amounting to over 250 pilots and a total personnel of considerably over 3,000, gives an impression of the part played by Australia in gaining the British air supremacy.

From South Africa, on the outbreak of war, came many potential aviators, and by the beginning of 1916 nearly 2,000 were serving in England or Egypt as probationary flight officers. When the 28th Squadron, R.F.C., was sent to co-operate with the forces in East Africa, it was largely composed of South Africans, and came to be known as the South African Squadron.

The total number of South Africans who were commissioned in the flying services was about 3,000. The colony, also, presented a large number of machines to the Imperial Government during the war.

The Tank Plane-Squadron

Tanks and aeroplanes during the closing months of hostilities proved a wonderfully useful combination in the breaking of the immensely strong Hindenburg Line.

No. 8 Squadron, R.A.F., was detailed for the special duty of co-operation with the Tank Corps, and thenceforward the "blindness" of the tanks was very largely neutralised.

The first step was to establish a thorough liaison, and for this purpose, and in order that each arm might learn the methods of work of the other, officers of the Tank Corps were attached to No. 8 Squadron, and vice versa. The period of preparation was short, and on July 4 tanks went into action for the first time definitely escorted by aeroplanes.

The objective was Hamel, and in spite of the fact that the day was a bad one for flying, with clouds at 1,000 feet, No. 8 Squadron maintained contact, successfully reported obstructions, and helped to dispose of them by bombing and machine-gun fire. Hamel was only a small operation, but it was a complete success and demonstrated very clearly the possibilities of the partnership.

After this action the training was continued intensively in preparation for the great Allied offensive. The duties of the squadron were roughly two :

(a) Maintaining contact.
(b) Anti-tank gun attacks.

The serious work began with the battle of Amiens on August 7. Once again weather conditions were adverse, for the British advance opened in a white mist. In spite of this, however, flying very low, the machines of No. 8 Squadron maintained touch with the advancing tanks, and kept the various Brigade Headquarters continually informed by dropped messages detailing the points they had reached.

The machines detailed for the gun attacks located numerous anti-tank gun positions. The tanks were warned of their presence and halted while the planes dived upon the concealed batteries and by dropping bombs and concentrating intense machine-gun fire scattered the gunners, thus enabling the tanks to resume the advance.

Throughout the remaining period of the German retreat the squadron worked in conjunction with the tanks, and it was largely as a result of this co-operation that the German tactics of attempting to hold our advance by concealed strong points failed so conspicuously.

No. 74 Squadron

The operations carried out by No. 74 Squadron were entirely of another nature. It was a fighting squadron and numbered amongst its pilots such great flyers as Bishop and Mannock. The squadron went out to France in the middle of April, 1918, and from that date until the cessation of hostilities accounted for no fewer than 223 enemy machines.

The first time the squadron was in action, only a few days after its arrival, five German aeroplanes were destroyed without any casualties. A few days later, five machines of the squadron engaged eight enemy aircraft and put down seven of them—again without loss to themselves. These successes continued until a total of 100 enemy machines had been destroyed in eighty-three days. The score continued to mount up—generally in small batches. In October a German formation of five was completely destroyed, and the following day a strong patrol of the squadron meeting seven Huns put down six of them.

One of the most satisfactory features of this record was the remarkably small number of casualties suffered by the squadron. From April until November 11—that is, the whole of its period

Photo] [*Topical.*

A GERMAN VIEW

A remarkable picture of British Tanks at Cambrai. Taken during the battle by a German airman, and afterwards captured from him when he was brought down.

of active service—less than thirty pilots were killed or taken prisoners.

Reprisals Squadron

"Reprisals Squadron" (No. 216, R.A.F.) was formed by the Royal Naval Air Service in September, 1917, specifically for the purpose of carrying the aerial war into Germany—as Germany had carried it to England; and it more than justified its title, as the squadron records bear witness.

The famous pilot who made the first flight from England to Constantinople, Commander Savory, D.S.O., was the first C.O. of the squadron, which he took to France on October 5. The first home of the unit in France was Ochey—where, with Nos. 55 and 100 Squadrons, the Independent Force originated.

Operations were soon begun, and on October 25 the squadron made its first mark on Germany by dropping 4¼ tons of bombs on the Burbach Works at Saarbrucken, in which raid nine Handley-Page machines were employed.

Wasted Hun Fury

Then ensued a period of bad weather—which hindered operations considerably. The first raid, however, had awakened the Hun to this new menace, and, having located the aerodrome, he bombed it for the first time on November 15, and again a week later. Luckily many useless bombs accounted for the small damage inflicted. The enemy made no further serious attempt until February, 1918, and it was then decided to move the camp to the shelter of a neighbouring wood, close to which the machines were also hidden. The Germans apparently never discovered this artifice, for the old hangars were left standing, and these empty sheds were bombed with great persistence until August. This bombing of the deserted aerodrome was a source of much amusement to the squadron.

Meanwhile the "Reprisals Squadron" was living up to its name, and the Germans for the first time were having the war from the air brought home to them. On January 24 Mannheim was reached for the first time, and twelve 112-lb. bombs were dropped on the Badische Anilin und Soda Fabrik, while Thionville also had its first visit the same night.

Although a shortage of machines hindered the work, for some time only four being available in the squadron, one by one the other towns of the Rhine valley had the unwelcome attention thrust on them—Cologne having its first experience of their visitation in March.

Towards the end of April the supply of machines improved, and from the beginning of May the full complement was always available. In this month nearly twenty tons of bombs were dropped on Metz, Mannheim, Kreuzwald, Thionville, Saarbrucken, etc.

Carrying the Air War into Germany

With the addition of many more squadrons and the definite formation of the Independent Force in June intensive bombing began, and No. 216 went farther afield for its target—then bringing the war home in very substantial fashion to still larger areas of Germany. Stuttgart and Offenburg were notable targets—at the former town the Benz Works being almost completely wrecked and the Johannes Barracks demolished, while the station at Offenburg was destroyed and all traffic held up from July 25 to 30.

In August Frankfort was bombed and the Black Forest was set on fire by special incendiary bombs and cans of petrol. This fire was reported as burning for several days before it could be extinguished. The climax of the intensive bombing was reached in September, in that month this squadron alone dropping over thirty-seven tons.

Many surprises were in course of preparation for the enemy, including the bombing of Berlin, and there can be but little doubt that the knowledge of these preparations and the healthy fear they inspired were largely instrumental in determining the now beaten enemy to appeal in November for an armistice.

Though the squadron had participated in no fewer than 162 raids from October, 1917, to November, 1918, only six machines were lost in Germany—a remarkably small loss. In this connection one machine in the unit—H.P. 3127—had a rather wonderful existence. It was brought out with the squadron to France—went through the whole of the active service with them, and was actually the last machine to return from the last raid

in Germany. Previously to being transferred to No. 216, this same machine had carried the King and Queen of the Belgians to England, and had been on active service from May to October, 1917, on submarine patrols, etc.—which, for those who know the average life of an aeroplane under war conditions, will appear a remarkable history.

The C.I.B.

During the closing stages of the war it was constantly reported in the official *communiqués* that "troops and transport were bombed and machine-gunned from a low height." Although, of course, any machine doing an "offensive patrol" would engage any likely ground target, the discovery and engagement of such targets by large patrols of machines was not fortuitous chance, but was the result of a wonderfully efficient reconnaissance service combined with what were known as "Central Information Bureaux." These bureaux were special wireless stations established at conveniently situated central spots in different zones, and linked up by wireless or telephone with various squadrons in the vicinity.

When the fighting line was stationary it was generally possible to engage concentrations of troops, columns of transport, or other "fleeting opportunity" targets by long-range gun-fire after they had been located and reported by wireless from British reconnaissance aeroplanes. But with the beginning of open warfare, and when the Germans were retiring so fast that they were often beyond the range of British heavy guns, another system was devised for the harrying of the enemy.

Far beyond the enemy's front line our reconnaissance machines would patrol, ever on the watch for likely targets. The Germans, happy in the belief that they were beyond the reach of serious molestation, would fill the roads in their rear with dense columns of troops. Little notice would be taken of the solitary English machine overhead. Meanwhile the wireless key above would be tapping out the information.

How the R.A.F. found its Targets

Within two minutes the news would be received by the Army and Corps Squadrons, where, on each aerodrome, flights

detailed for this particular purpose would be lined up ready with pilots and observers standing by. A minute later the first machine would have left the ground, rapidly followed by the remaining duty machines. Having the precise "pin point," or map reference, the flights from the various squadrons would make direct for the target, where they would "rendezvous" to the consternation of the Germans, who would suddenly perceive clouds of British machines bearing down upon them from various points on our front, and, before they had time to scatter, the first flight would be over them, the bombs would rain down upon the close-ranked column, rapidly followed by many more as the successive flights arrived and dived upon the target.

Then streams of bullets would rain down upon them as each plane dived yet lower and opened with its machine-guns upon the straggling disordered mass in the choked roadway.

This system was not confined to the reporting of ground targets. In the same way concentrations of German machines, setting out, perhaps, on a bombing raid or gathering to intercept a long-distance raid of ours returning from its work, would be reported to the C.I.B. by our watchful scouts, and once again the waiting planes would rise from their aerodromes and fly swiftly to engage and destroy the enemy.

In this way the R.A.F. rendered invaluable service to the Army in the closing stages and did much to counterbalance the inability of our heavy guns to keep pace with the swiftly retreating and harassed enemy.

"Low Strafing"

Perhaps the most striking development in these particular sections of the air arm during the closing stages of the war was that section which was devoted to what was popularly known as "low strafing." This consisted in bombing from very low altitudes—anything from 100 feet to 1,000 feet—and machine-gunning prominent ground targets, principally troops and transport, very often even under the former height. This form of aerial offensive was initiated by the R.A.F., and the moral and material effect upon the Germans was tremendous. Prisoners spoke of these tactics with terror. Captured German airmen could never understand how British machines were able

to do this so consistently with such comparatively small loss, and marvelled at the daring of our flying officers. The German High Command issued repeated army orders declaring that their troops must render it impossible, and outlined schemes of defence, all of which proved quite ineffectual.

That these tactics were demoralising is not surprising. Imagine a column of troops or transport on the march. Suddenly high above in the distance appear numerous dark specks, which, as they dive steeply towards the column, reveal themselves as British aeroplanes. Orders are shouted down from the head of the column to thin out; to scatter—anything to escape these terrifying planes, which, with a mighty roar of engines, are approaching at 200 miles an hour.

Strafing a Marching Column

Disorder runs the length of the column, horses become unmanageable as the drivers strive desperately to pull their vehicles to the sides of the road. Before even the infantry have had time to scatter, the planes are over them; so close that the pilots and observers can be seen clearly as they set their bomb sights. A scattered fire breaks out, but nothing can turn these intrepid airmen from their course. Then, with shrill whistles, the tiny but powerful Cooper bombs rain down; scores of them bursting along the road—among the maddened horses—in the midst of the panic-stricken infantry. Explosion follows explosion, in a tearing, rending crescendo of sound. The road is choked with maddened, dying horses and fallen men, but the terror is not over yet. Back come those triple-ringed planes; lower this time, and following one another in Indian file along the winding road. Over the broken column machine-guns spit forth streams of lead, in the fiery trail of the tracers marking their path. Men and horses fall in scores, wagons and guns overturn. Riderless horses and men scatter wildly over the surrounding fields. All attempt at resistance is finished. Once more the planes sweep the flying troops with those chattering guns, chasing rapidly dwindling groups or solitary fugitives.

The column has ceased to exist. A mass of wreckage blocks the road. Dead Germans lie everywhere. And the aeroplanes

return to their aerodromes for more bombs and ammunition for their next target.

This is no imaginative picture. It is actually what happened many times a day when the Germans began their offensive, and the roads were crowded with their supports and supplies.

And once again this nerve-racking, demoralising and death-dealing aerial strafing took place when the Allied offensive in turn drove back the Germans, and in a vain endeavour to stem the tide they pushed up division after division into their rapidly crumbling line.

And to picture another feature of the low-flying squadron's work : what more terrifying than a score of planes which, flying along a trench from which there is no escape, pour out streams of bullets upon the crouching garrison. One has but to experience the sensation once to realise fully the effect. Now and again an odd German pilot, more daring than his fellows, would treat us to the same experience. But that was comparatively rare. Not so with the British aeroplanes. Day after day—aye, and at night also, squadrons of the R.A.F. detailed for this particular job would give the harried Germans no peace. From prisoners we afterwards learnt something of the effect, but who can tell to how great an extent the "low strafing" of our airmen contributed to the utter breaking of the German moral?

The Eyes of the Canadian Corps

Though not actually a Canadian unit, No. 5 Squadron, R.A.F., co-operated with the Canadian Corps during the last phase of the war. This squadron, of course, was one of the original units of the R.F.C., and went out to France in 1914. It was attached to the Canadian Corps in July, 1918, and the subsequent operations in which it took part may be divided into four phases :

(1) Battle of Amiens.
(2) Arras—Cambrai offensive.
(3) Douai—Valenciennes offensive.
(4) Valenciennes onward to Armistice.

On August 4 the squadron received orders to move down to Bouvelles, near Amiens. During the next four days the officers

of the squadron were busy making themselves familiar with the whole of the ground over which the attack was to be pushed.

The Battle of Amiens

The battle opened on the morning of August 8, and the first patrol of four machines left the ground at 4 A.M. in a thick white mist. These weather conditions rendered the work extremely difficult and dangerous, for the pilots were forced to fly at a height which barely cleared the tree-tops.

During this first patrol these four machines kept contact with the advancing infantry, and also succeeded in locating suitable targets and engaging them with bombs and machine-guns. One of these machines was shot down on the German lines; another had a forced landing, but succeeded in reaching our own lines safely; while the remaining two machines returned to the aerodrome at 7.30 A.M., when relieved by a fresh patrol.

Gradually the sun broke through the mist and disclosed a scene which the pilots who happened to be up at the time described as extraordinary and rarely to be witnessed. The Canadian troops had completely broken the enemy front, and the Germans could be seen retreating in great confusion, closely followed by infantry and tanks.

Farther to the rear the ground appeared to be black with all kinds of troops on the move. The guns were being galloped back to escape the headlong advance of the Canadians. German infantry supports were endeavouring to make their way forward through the retiring and broken remnant of front-line troops to check our progress.

Behind them again the roads were absolutely congested with enemy transport, all hastily moving to the rear, while our scout machines were everywhere, diving to within a few feet of the ground and raking them with bombs and machine-gun fire.

Behind the advancing Canadians the ground was likewise thronged with troops and transport pushing forward to support the advance. The pilots remember noticing particularly several brigades of cavalry pushing up, and also the stream of prisoners being passed back to the collecting stations in the rear.

Contact and observation patrols from the squadron followed one another continuously throughout the whole day until dark-

ness fell, maintaining touch with the infantry, locating strong points and engaging ground targets. This work was carried on until the close of the Amiens battle on August 22, and some idea of the amount of work done may be gathered from the fact that during this period alone 450 bombs were dropped, over 400 photographs taken, 50,000 rounds of machine-gun ammunition fired, and 250 enemy batteries silenced and destroyed.

On August 23 and 24 C Flight was detailed for work with the Australians who were advancing from the Albert-Bray front.

During the Amiens advance ground was covered so quickly that two successive advanced landing parties and grounds had to be established by the squadron in order that pilots might land there, fill up with petrol, etc., and so increase their radius. Reports were also handed in here on the return from patrol in order that they might the more quickly reach Corps Headquarters. These advanced landing grounds were actually under shell-fire, the first being at Amiens and the second at Caix.

Work in the Arras-Cambrai Advance

The next phase was the Arras-Cambrai advance. For this the squadron was moved up to Izel-le-Hameau on August 25, and the following day the battle began. The difficulties in this phase differed somewhat from those of the first stage. The enemy lines here were particularly strongly fortified, and consequently a very heavy artillery barrage was necessary to enable the infantry to make headway.

During the first portion of this phase the machines of the squadron carried out their work actually under the trajectory of this concentrated fire, and some of them were destroyed by our own shells. In this connection one extraordinary escape is on record. The engine of a machine actually received a direct hit from an eighteen-pounder shell, which, however, luckily did not explode. The pilot was able to flatten out and land safely in our own lines.

During this period the extensive use of smoke shells by the Canadian infantry very considerably hindered the work of aerial observation. Particularly fierce ground-fire was also met with, and it was discovered that the Germans had here constructed a

series of concrete machine-gun emplacements for their anti-aircraft gunners.

By this means the enemy was enabled to put up a very fierce barrage, and our machines in nearly every case returned riddled with bullets. As soon as the Canadian troops had broken the strongly entrenched lines and had crossed the Canal du Nord, the enemy fell back upon his system of covering his retreat by a series of cunningly hidden machine-gun posts and strong points.

This necessitated a change of method on the part of our aeroplanes. Those posts were hard to locate, and when the infantry advanced would hold their fire until the British troops were close up in force and then would be able to inflict many casualties. Here again the R.A.F. came to the aid of the infantry, and by the tactics adopted once more undoubtedly saved very many lives. Our machines began to fly low over the suspected areas, and it was found that the enemy could never resist the temptation of shooting at the plane, thus giving away their posts.

It was, of course, a risky thing for pilots and observers, but was very well justified by results. Sometimes areas thought to be defended were found to be evacuated, and the infantry were able to push on in force without the delay of sending out patrols.

A chase of this sort occurred on September 3, when one of the machines was flown at only 100 feet over the area thought to be strongly defended. The enemy had moved back several miles in the night, and the observer was able to report this at once and so save valuable time. While this work was being done by certain machines, others were directing shoots upon cross roads, bridges and railway junctions, far in the enemy's rear, greatly hampering his retreat and enabling the infantry to make considerable captures.

It was about this time that the Brigade of Armoured Cars did such useful work. One machine of the squadron was detailed for contact work with the cars and so constituted materially to their success. Whilst engaged on this work, Lieutenant C. G. Fraser and his observer, Second Lieutenant A. J. Bishop, were attacked by five scouts, and although both

were wounded they succeeded in destroying one enemy machine and continued to fight until their controls were shot away. The pilot managed to land his machine in our own lines in spite of this.

Owing to the accuracy of the Canadian counter-battery fire, the Germans here resorted to alternative gun-emplacements. On this becoming known certain machines were detailed to locate and report active emplacements, thus preventing many thousands of rounds being fired at emplacements from which guns had been moved at night. This saving of ammunition was an important factor in view of transport difficulties during our rapid advance.

Canadians in the Last Phase

November 1 saw the beginning of the last phase of this wonderful advance, and for No. 5 Squadron it proved the easiest time of all. Our scout machines, in this sector at any rate, appeared to have won a definite supremacy, and the reconnaissance machines were no longer bothered by hostile aircraft. Moreover, it had been necessary for the enemy to withdraw his anti-aircraft guns so far that during this period very little "Archie" was encountered.

There, however, arose the difficulty of locating the enemy, who sometimes retreated as much as 10,000 yards in one night, in some cases even getting beyond the range of our guns and thus rendering artillery observation work impossible. The squadron therefore concentrated on contact and low strafing work with very successful results.

During the last few days officers of the unit received much help from the fact that as soon as the Germans vacated a village Belgian and French flags would almost miraculously appear on the roofs of the houses, thus indicating the limits of the enemy retirement. On November 8 the squadron made its last move before the fighting ceased, namely, to Valenciennes itself, where it was located when the Armistice was signed.

CHAPTER X

FINAL VICTORY OF THE ITALIAN AIR SERVICE

A British Effort—Regaining that Lost Moral—Austrian Struggle to Regain Supremacy—Italian Spring Recovery—Struggle for the Piave Line—Nearing the End—The Eve of the Offensive—Remarkable Adventure of a British Airman—Incidents of the Great Battle—Work of the Camel Squadrons—A Compliment from the Enemy—Italian Air Offensive—Gallant Death of Major Baracca—British Co-operation—Air Work in the Italian Advance—Gabriele D'Annunzio—Raid into Buccari Bay—The Messages in the Bottles—Exploits of D'Annunzio—August 9, Italian Raid on Vienna.

"THE work of the Royal Air Force under Colonel P. B. Joubert, D.S.O., has been consistently brilliant, and the results obtained have, I believe, in proportion to the strength employed, exceeded those obtained in any other theatre of war. Between March 10 and the present date 294 enemy aeroplanes and nine hostile balloons have been destroyed, and this with a loss of twenty-four machines. Much useful work in co-operation with the artillery has been carried out, and frequent and successful long-distance reconnaissances accomplished. The action of the artillery, both British and the Italian, which had been temporarily placed under my command, deserves special mention. Constant and effective counter-battery work has been carried out. The damage done has been fully confirmed both by visual observation, photograph and prisoners' statements."

(So read the dispatch from the Earl of Cavan, the British C.-in-C. in Italy, dated September 14, 1918.)

On no front, except in Palestine, did the Royal Air Force achieve such a complete mastery of the air as it gained in Italy during the twelve months in which it was represented on that front.

This mastery did not come to it easily. In fact, when the first British wing arrived in Italy they found the aerial position

very unsatisfactory. After the Austrian victory at Caporetto the retreating Italians had lost a number of aerodromes and very many machines, and it took some time before those losses could be made good. The Austrians were flushed with victory, and their pilots were bold and aggressive; while their numbers had been swollen recently by the arrival of several German squadrons. In fact, the enemy air services could scarcely have wished for a happier state of affairs.

Regaining that Lost Moral

The Austrian pilots were probably very much surprised when on November 29, 1917, they saw an R.E.8 machine, marked with the British rings, photographing the Montello area. Five of them immediately swooped to the attack, but so inferior was their skill to that of the British pilot, that the R.E.8 managed to escape.

From that day onwards the Austrians found their mastery of the air stoutly challenged by a Brigade of the Royal Air Force. Three squadrons of British scouts commenced a ceaseless series of aggressive patrols, while the R.E.8 squadrons bombed the more advanced aerodromes of the Austrians and straightway caused one to be evacuated.

"The first shots exchanged between the British Expeditionary Force and the Germans on the Italian front have brought success to our arms," wrote Mr. G. Ward Price, British correspondent at Italian Headquarters, on December 3, 1917. "It was an encounter in the air, and the Royal Flying Corps opened this new campaign with an achievement of good augury, for the very first day that our airmen crossed the enemy lines they shot a German machine to pieces and sent it crashing to earth on the banks of the Piave.

"Four of our machines crossed over to the German side of the river for a flight along the northern sector of the plain. The little squadron had not gone five miles before they were attacked by five German Albatros scouts. One of these enemy machines was immediately driven down in a vertical dive, but at 5,000 feet it flattened out again.

"Meanwhile the fight went on with the rest. After twenty minutes of continual manœuvring and occasional bursts of fire

another of the enemy was driven down. His British antagonist followed him in his dive, and as the German flattened out again the English pilot got a burst of eighty rounds into him at close range. That ended the fight. The right wing of the German machine collapsed and fell back along the fuselage. At once the Albatros turned over and fell, the rest of the right wing breaking loose as it crashed to earth.

"By this time the enemy had received reinforcements, but for all that another of his aeroplanes was driven down out of control below 5,000 feet. Then the four British machines returned, having encountered in this first outing of theirs twelve German adversaries, of which they had smashed up one and seriously damaged two.

"Flying conditions here were very different for our airmen from those to which they were accustomed in France. For one thing they had to carry out reconnaissance flights above high mountains. Good landing-places are very scarce even among the plains."

Austrian Struggle to Regain Supremacy

The Austrians retaliated to this activity by a big raid on Boxing Day, 1917, when about forty-five machines attacked an aerodrome at Fossalunga. They did no damage, but lost no fewer than eleven machines before they could recross the Piave.

Throughout January, 1918, the enemy maintained his aggressive spirit and made daily photographic reconnaissances over the British areas. Their losses, however, were so heavy that they were presently forced to desist. From the time of their arrival on the Italian front the Allied airmen scored heavily in Austrian aircraft. Thirty-nine out of a total of sixty-two enemy aircraft brought down on this front during January fell to the British aviators, who achieved these victories with a loss to themselves of only five machines.

By February the British, working in conjunction with the Italian squadrons, had completely reversed the position of two months before. The Allies were supreme in the air and the Austrians rarely ventured to cross the lines. By this time, since their arrival on the Italian front, the British airmen had

brought their total number of victories up to fifty-eight, with a loss of only eight aircraft.

Italian Spring Recovery

By the spring the Italians had recovered from the effects of Caporetto and were wholeheartedly working with the British in the air. At the same time the great German offensive in France caused the withdrawal from Italy of some land and air units of the British Force. There remained in Italy one R.A.F. wing composed of four squadrons and a balloon company. Two squadrons had Camels, one had Bristol Fighters, and one R.E.8's.

Shortly afterwards one squadron moved from the Montello to the Asiago front, where reconnaissance work was found to be most difficult. All hostile batteries were concealed in pine forests; while the moving deep shadows of the mountains made it necessary to photograph certain areas several times.

The R.E.8's about this time handed over distant reconnaissance work (which they had carried on successfully and without loss) to the newly arrived Bristol Fighters.

British airmen on the Italian front did extraordinarily well. They destroyed eighteen enemy machines and drove down three out of control, while the gunners brought down one—twenty-two in all without loss to themselves. Since their arrival in Italy British pilots and gunners destroyed 101 enemy machines at a cost of ten aeroplanes, while the Italians brought down a further eleven. During May British airmen maintained their fine supremacy. They destroyed forty-eight enemy machines and two balloons with a loss to themselves of only two aeroplanes. They had now destroyed 157 Austrian aeroplanes since they went to Italy, and their total losses for the same period were fifteen machines. While in addition to the forty-eight, Italian airmen accounted for eighty-four of the enemy, who claimed in the same period to have destroyed four Allied planes.

Struggle for the Piave Line

On June 15 the Austrians made their great attempt to beat back the Allies from the Piave line. On this day driving rain, clouds and mist prevented much air work from being done on

the Asiago plateau; but on the Piave front the Royal Air Force vigorously attacked the enemy troops with bombs and machine-guns. These operations played a considerable part in the defeat of the enemy.

Again Mr. Ward Price wrote from Italian Headquarters: "The bridges over the Piave are so constantly cut by shell-fire that the Austrians are actually having to use aeroplanes to bring supplies across the river.

"Last evening I watched the Italian and British airmen as they bombed and fired on the Austrians on the slopes of The Montello. One British airman, I heard later, having dropped all his bombs and emptied every drum of cartridges, came down to within a score or two feet and pelted with his spare parts and tools in his repair outfit the Austrians cowering under the banks and among bushes."

Nearing the End

From this time on till the great Allied advance in October, the R.A.F. held almost undisputed supremacy in the air. Once, it is recorded that the famous Austrian pilot Lieutenant Navratil himself led a formation of D.3's across our lines. They were at once attacked by three British machines. Navratil himself fled early in the fight, but the other four machines were brought down.

Before the Italian offensive on October 27 certain squadrons moved their aerodromes without the knowledge of the enemy. Up-to-date photographs became a matter of supreme urgency, and despite very unfavourable weather these were all obtained by one pilot by the 22nd of the month. The photographic section of this squadron worked all night and produced 5,000 prints of the latest photographs by 7 o'clock the next morning.

The Eve of the Offensive

This remarkable photographic feat occurred on the eve of the offensive. Once the battle started the R.A.F. acted vigorously. Italian agents were dropped by parachute far behind the enemy's lines, and the most advanced troops were kept well supplied with ammunition by air. One airman attacked an Austrian retreating 5.9 battery and with bomb and machine-gun killed 100

men attached to the battery. Circling low over it he prevented any attempts at salvage until the advanced British patrols completed the capture.

Another airman, flying at forty feet, raked a house used as an officers' mess with his machine-gun, and chased and shot down the ground staff and mechanics, who were running in all directions.

He next attracted the attention of two Sopwith Camels, and the three together attacked a two-seater and a scout which were preparing to leave the centre of the aerodrome.

The first pilot came down to ten feet and fired a long burst into the two-seater machine, which broke into flames. His companions fired over 500 rounds into the scout, which was also destroyed. The ground staff were so demoralised that they abandoned their machine-gun and fled.

Incidents of the Great Battle

For the first three days of the battle the R.A.F. squadrons vigorously carried out artillery and contact patrols, and on the first day there were six aerial combats. On the second day the Austrians shrank from air fighting, and on the third day only one hostile machine was seen. The Austrian defeat was now becoming a rout, and the fighting had moved off the detailed maps. The enemy was hurriedly withdrawing his artillery and so no counter-battery work was needed. The artillery flights therefore joined in the general reconnaissance work. A few demands for ammunition for the infantry were successfully met; but the urgent need was the collection and distribution of fresh information about the retreating Austrians. Pilots showed great initiative and judgment in keeping the British and Italian cavalry informed of the situations in front of them, and they sometimes landed on enemy aerodromes, only evacuated a few hours before, to give information to advanced parties of the Allies.

Work of the Camel Squadrons

The Camel squadrons, having destroyed or forced down all enemy balloons and driven down the enemy machines from the skies, gave all their energies to bombing and shooting the

masses of retreating Austrians on the roads. The havoc they caused was enormous. Roads were blocked with overturned transport and guns, and the ditches were filled with dead and wounded men and horses. One patrol brought about the capture of an entire battery of 5.9 howitzers, and one of the guns was allotted as a trophy to the squadron to which the patrol belonged.

The British balloons were likewise usefully employed in helping the artillery in the first three days of the battle, but after that the battle had moved out of their ken, and the pontoon bridges were not strong enough to permit of them catching it up.

During the battle 293 offensive patrols were carried out, in which nine enemy machines and seven balloons were destroyed, in addition to many machines driven down out of control. The British lost seven machines, nearly all as the result of extraordinarily low flying—sometimes the height was only thirty feet. Nearly 200 tons of bombs were dropped and over 51,000 rounds of S.A.A. were fired at ground targets. The Austrian army was completely blinded, while the Allies were constantly supplied with information. Thus the Royal Air Force made a notable contribution to the defeat of the Austrian Army.

During the twelve months spent in Italy the Royal Air Force destroyed 386 enemy aeroplanes and twenty-seven balloons, while thirty-three machines were driven down out of control. The British losses were forty-seven machines missing and three balloons destroyed.

The Austrian squadrons, though greatly superior in numbers, were out-generalled and out-fought. Prisoners admitted that they were nonplussed by the ubiquity of the British airmen and consequently over-estimated their strength. The bravery and skill of the British aviators received the highest compliments from captured Austrian airmen—probably the best testimonial which fighting men could desire.

A Compliment from the Enemy

After so useful a record it will cause little surprise to find no less a person than General Uzelac, Chief of the Austrian Air Force, paying an acceptable compliment to this good work

of the R.A.F. pilots and observers in Italy. Germans never excel at the gentle art, and General Uzelac is no exception. In a characteristic eulogy of the work of his Austrian aviators—an interview accorded the *Berliner Tageblatt*—however, he can find nothing worse to condemn in his British opponents than their intense love of sport. "The Austrian pilots," he said, "were considered quite first-class by the Germans themselves, although, of course, owing to their high average intelligence and general training in sports, the British had a better supply of men as regards quality."

Italian Air Offensive

In the Italian air offensive every type of aircraft played its part. While the seaplanes were instrumental in keeping the Austrian Navy inside its own harbours, a duty in which airships rendered invaluable aid, there was a very noticeable development in new types of Italian aeroplanes. Several of these aircraft in the summer and autumn of 1918 established world records for long-distance flights, without, however, in any way impeding the continual and intensive offensive campaign over the battle lines.

Bombing appears to have been a strong point with the Italian air arm. Daring, effective, and, for the enemy, entirely demoralising, their bombing squadrons gained world-wide renown, particularly that squadron which was led by the quixotic adventurer Gabriele d'Annunzio. While, however, his dashing propaganda raid on Vienna will live as one of the most daring efforts of the Austro-Italian war, equally useful, if less spectacular, raids were being carried out by lesser-known leaders almost every day and night.

Gallant Death of Major Baracca

It was while conducting such a bombing raid that Italy's greatest airman, Major Francis Baracca, met his end. Only thirty years of age, a member of the Italian Flying Corps since 1912, and with thirty-four enemy machines to his credit, his death gave rise to many stories. His fellow pilot declared that he had shot himself when his machine became out of control; he had always said that he would not fall alive into the enemy's

hands. He was bombing a bridge over the Piave at 500 feet above the wooded Montello Hill. Suddenly his machine, on which was painted the prancing red horse he had made famous, heaved over and fell gliding on a wing. As it drifted towards the ground the Austrian gunners opened a vigorous fire with incendiary bullets, which brought the machine down in a burst of flame. Some days later the charred and almost unrecognisable body of the major was found by the advancing Italian infantry.

The periods of greatest activity on the part of the Italian military aviators occurred in January and again just before the Armistice. Two large bombing aeroplanes, on the night of January 14, carried out an unusually daring raid. There was no moon on that occasion, and a heavy bank of clouds lay over the snow-covered terrain, blotting out the mountain peaks. Reaching a height of nearly 12,000 feet, the machines passed over the Asiago Plateau above the Cima Dodici, which is 7,800 feet high, and then above the Val Sugana, until they reached their goal at Levico, a very important supply centre in the rear of Conrad's army. Twenty bombs were dropped on the railway station and military depots, and several fires were seen to break out. Both the aeroplanes returned safely, having covered a distance of 125 miles in an hour and forty minutes.

British Co-operation

During February the combined forces of Italian airmen and members of the R.F.C. in Italy destroyed forty-five Austrian and German machines—twenty-three by the Italians, and twenty-two by the British. In addition, French airmen crashed two enemy machines, Italian gunners shot down three, and the British drove down one out of control, a total of fifty-one. The superiority which the British airmen had gained over the enemy was established by the fact that in one week during the month they destroyed fifteen German machines and drove down one with a loss to themselves of only one aeroplane, and that from January 26 to February 21 they accounted for fifty-eight enemy aeroplanes while they themselves lost only eight machines.

Air Work in the Italian Advance

This supremacy they consolidated in the February Italian advance. "British, French and Italian machines," said Mr. Ward Price, "were in the air on this sector during the battle, and not less than twelve enemy machines which were observing or trying to bomb places where Italian troops were gathered for the assault came crashing down on to the mountain slopes. The Italian front has, indeed, been costing the Austro-German Flying Corps dear lately. Hardly a day passes but they lose several machines to the attacks of our aggressive Allied airmen, and this in spite of the fact that they habitually do their best to avoid an encounter."

The next aerial action of any importance did not take place until after July was well advanced. On the 24th of that month, then, a number of Italian aeroplanes flew to the Austrian base at Durazzo and dropped a ton of bombs. A steamer was damaged and several depots were struck and fires were observed. The following night another party of aeroplanes proceeded to Durazzo and dropped bombs. On August 21 Pola arsenal and torpedo-boat anchorage were successfully bombed. Four days later British aeroplanes bombed the aerial station at Durazzo, causing fires, and shortly afterwards naval planes bombed steamers at anchor in the harbour. About seven tons of bombs were dropped by Italian aviators on August 22 and the following night upon aviation camps in Lagarina Valley and in the Friuli plains. One of the unusual services rendered by these military airmen is recounted by Mr. Ward Price.

Three bridges across the lower Piave, which the enemy was using for supplying his troops, were destroyed by the British monitor *Picton*. The range was 18,000 yards (10¼ miles), and the three bridges lay 200 yards apart. One was a stone bridge which the Austrians had repaired; the other two were three yards wide. On these slight marks the monitor's guns put five hits out of seven shots. The very first shot was on the target, and the pontoon bridges were each hit at either end, one of them being so effectively cut in two that the aeroplane observer reported that the middle part of it floated away down-stream. A shell also dropped right into the stone bridge.

Final Victory of the Italian Air Service

Gabriele d'Annunzio

It was only fitting that the daring squadron commanded by the poet-airman, Major Gabriele d'Annunzio, should be styled the "storm troops of the air." It was a nickname full of meaning, which was given them by their comrades after their famous bombing raid on Pola arsenal on July 17. Then the poet had said: "It was like cavalry attacking the enemy in the rear. The machine-guns simply wiped out the enemy's troops, especially the artillery. Dozens of batteries were left without men to serve the guns at the most critical moment of the battle." After this incident d'Annunzio and his followers wore on their flights in the air an ivory-hilted dagger—most appropriate emblem, the tiny weapon being the official badge of the Italian Arditi or storm troops.

Raid into Buccari Bay

D'Annunzio's leadership of the Italian raid into the Bay of Buccari on February 10, 1918, first attracted general attention. At that time he was popularly supposed to be a prisoner in German hands; he wrote to a friend these aerial adventures:

"With three armed motor-launches and three seaplanes we forced our way into the Gulf of Quarnero. What a magnificent adventure! I was twenty-three hours on the sea, eight of which I spent in the very throat of the enemy, or rather, I should say, in the depths of his stomach. Never was there such a real dream. We were quite alone in our little boat. We passed through the Faresina Channel with an impudence akin to madness. We steered less than fifty yards from the Austrian coast, and in the narrow Bay of Buccari we remained for a space of thirty-five minutes.

"Having torpedoed a ship which was anchored there, we made our exit amidst the roar of the explosion. I left floating on the water three bottles which flamed with the three colours of Italy, and the astonishment of the Austrians must have been immense. The sentries fired wildly."

The Messages in the Bottles

It was only characteristic of the man, the thought of the bottles, but even more so was the galling message enclosed in

them. D'Annunzio spared the Austrians no word. "Contemptuous," he wrote, "of the cautious Austrian fleet which occupies itself behind the shelter of its guarded ports in nursing the little bit of glory which it won at Lissa, the Italian Navy has come with fire and flame to dispel confidence even in the safest retreat. The Italian Navy laughs at every kind of net and barricade, and is always ready to dare the impossible. With them also has come a good companion, whom you know well the principal enemy, and amongst your enemies the most bitter, to laugh at the price you have laid on his head—Gabriele d'Annunzio."

Exploits of d'Annunzio

The historic raid on Vienna was yet to come. Meanwhile the poet laughed to scorn the Austrian price of ransom. A venturesome Austrian aviator early in July had the temerity to drop a bomb literally within a yard of his sleeping quarters. D'Annunzio was angered beyond measure. The thud had knocked over and broken the glass from which the poet had drunk but an hour previously. In this the soldier-poet gaily saw a matter for personal vengeance, and started off in the afternoon with his pilot in a new type of weight-carrying land machine. He flew about 100 miles straight across the Adriatic Sea to Pola, dropped fourteen bombs on the arsenal, and returned safely to his aerodrome.

Participating in the tenth raid on Pola, on July 17, when over a ton of high explosives were dropped on the arsenal and Broni Islands, on its homeward journey his machine was forced to land in the marshes near Venice. Over Pola his machine had swept down to within 350 feet of the ground, and the poet bombed and machine-gunned the Austrians with the utmost sang-froid although he paid for his daring. D'Annunzio was slightly wounded in the wrist, and a bullet also went through his boot.

August 9 Italian Raid on Vienna

D'Annunzio's long flight to drop propaganda pamphlets on the Austrian capital was the natural outcome of a new form of aerial activity initiated by the Italians. To carry news from the

Jugo-Slavs to their brother nationals in the Austrian Empire, Italian airmen were employed from time to time to fly over the towns of Carnolia, dropping leaflets of the recently made statement of Dr. Trumbish, together with the resolutions of the congress held in Rome. D'Annunzio's alert mind was not long in making use of this highly valuable form of warfare on a more extensive scale.

He determined to drop pamphlets on Vienna in the heart of the Austrian Empire, an aerial raid of a distance which had never yet been attempted. Accordingly at 5.50 A.M. on the morning of August 9 he set out with a patrol of eight aeroplanes.

Despite great atmospheric difficulties the gallant band arrived over Vienna by twenty minutes past nine, flying over the city at an altitude of only 800 feet, so that the astonished crowds in the streets could be seen with ease; they dropped several thousands of pamphlets. Fortunately the Italian machines were not attacked, and, returning home by way of Wiener Neustadt, Graz, Liabach and Trieste, arrived with no other casualty than the forced descent of one plane, which, owing to engine trouble, came down near Wiener Neustadt.

Again the proclamation was very typical of the daring leader. "People of Vienna," was the translation, "learn to know the Italians. We are flying over Vienna. We could drop tons of bombs, but we only drop a greeting to the three colours of liberty. We Italians do not make war on women, children and old men. We are making war on your Government, the enemy of national liberties, on your blind, obstinate and cruel Government, which cannot give you either peace or bread, and feeds you on hatred and illusions.

"People of Vienna, you have the reputation of being intelligent, but why have you put on Prussian uniform? You see that now the whole world has turned against you. Will you continue the war? To continue it is suicide for you. What do you hope for? For the decisive victory promised you by the Prussians? Their decisive victory is like the bread from the Ukraine. One dies while waiting for it.

"People of Vienna, think for yourselves. Awake. Long live liberty, long live Italy, long live the Entente."

CHAPTER XI

EASTERN FIGHTS AND FLIGHTS

Air Operations in Palestine—A German Expert's Tribute—A Turkish Catastrophe—The Turkish Rout—Outflanked from the Air—The R.A.F. on the Red Sea—Flying in "Mespots"—Over Persian Deserts—An Adventure in Persia—An Air Hunt on the Tigris Front.

THE operations in Palestine were colloquially known as a "side show," and in relation to the titanic struggle on the Western Front, the description had aptness; but the Palestine operations put Turkey out of the war, and it is bare justice to admit that that even had results of capital importance.

Therefore, even if the Palestine campaign had passed from the fleeting panorama of immediately current events, it is worth while to add, if only as a footnote to history, some of the facts regarding the work which made possible the Turkish rout and its results.

In Palestine the Royal Air Force produced a situation during the battle which was unprecedented, namely, the capture of an entire army in spite of the fact that the troops were up against an entrenched line. "Aeroplanes south of Amman," wrote Mr. W. T. Massey from Damascus, October, 1918, "secured the surrender of 2,000 Turks. A pilot, catching sight of a long, drawn-out column, dropped a message, saying that if they did not surrender they would be bombed. He returned to his aerodrome with no answer. Six machines then went up with bombs. While they were circling over the troops a ground signal was laid out recalling them. The Turks raised the white flag, and came in to be taken prisoners." The explanation of it all was the R.A.F. was a new factor in war.

A German Expert's Tribute

In a captured document of first-class interest, the German Imperial and Royal Liaison Officer with the 8th Imperial Otto-

man Army Headquarters discusses the situation in Palestine from the German point of view on August 29, 1918. The outstanding feature of his statement is his keen appreciation of the Royal Air Force and his scathing criticism of the German Air Service.

It is a platitude to describe the Germans as painstaking, thorough and industrious adapters of other people's ideas. Here is a German who, in an official confidential paper, is found envious of the adaptability of the R.A.F. For example, he writes :

"In my last report I indicated that, in the matter of aircraft, the enemy had enormous superiority, which consisted as much in the personality of the pilots as in the quality of the machines. Things have got so far that no further air reconnaissance is done by the 7th and 8th (Turko-German) Armies. Three flights are out of action, and distant reconnaissances, photographic work, special bombing expeditions and so forth can only be undertaken occasionally and with the greatest difficulty. The chasing planes are inferior to the enemy's, and it is painful to see how one crew sacrifices itself after another. It must be remarked that the tragedy, the technical deficiencies of our own appliances, arises out of the fact that the propellers are ' set ' for German air conditions, and in the much thinner air; while the English have taken steps to meet all local conditions."

A Turkish Catastrophe

Again, there is the invaluable testimony of a British infantry officer.

"I went," writes this officer, "for a very interesting drive yesterday along that road towards the Jordan where I told you in a previous letter that our aeroplanes made such a mess of the retreating Turkish transport. It must have been even a greater catastrophe than I supposed.

"There was a horrid mess up at the farthest place we reached. Some bombs had landed in the middle of them, and it was awful seeing corpses lying there not quite skeletons, but sufficiently so to see that horrid grin. . . . The result was so fantastic that I felt I wanted to laugh. And yet the whole thing was really one of the most ghastly tragedies in the history

of the war, comparable to the disaster at Thermopylæ or the retreat from Moscow. Just imagine thirty miles of guns, vehicles and men caught by aeroplanes in a long narrow gorge. . . . And the aeroplanes going back for more bombs! "

The Turkish Rout

Finally there are to be considered the tactics employed by the Royal Air Force and the Australian Flying Corps in the course of the operations which led to the taking of Nazareth on September 20.

The chief object of the British airmen was to prevent the enemy from gaining knowledge of important cavalry movements, and to that end big bombing machines remained throughout the night of September 18-19 over the principal Turkish aerodrome at Jenin, which was subjected to a constant rain of heavy bombs. Later it was found that tremendous damage had been done by the direct hits secured.

But the methods which were brought to bear at daybreak were nothing short of sensational. Fast machines in pairs, each carrying a number of 20-lb. bombs, flew over Jenin all day. Each pair of machines was relieved at prearranged intervals. Any movement on the aerodrome brought a bomb crashing about the ears of those responsible for it, and in actual fact the enemy never got a machine off the ground. As each machine was relieved its pilot dived down and sprayed the hangars with machine-gun bullets before making off for another load of bombs.

Outflanked from the Air

The inability of the Turks to get a single machine into the air permitted our cavalry to execute its critical turning movement without being observed, with the result that Nazareth was entered at 3 o'clock the following morning.

Equally remarkable results were obtained by the British flying men in their operations against the retreating enemy transport. The moment the retreat began, groups of machines, leaving the ground at three-minute intervals, flew over and bombed the head of each column. The Turks were thrown into utter confusion, and in every case the personnel of the

attacked column fled wildly to escape annihilation. In many instances two or three frightened soldiers scrambled frantically upon the back of a single horse and galloped away.

An eye-witness of the terrible carnage thus caused said, "It was appalling. Men, horses, guns and oxen lay in tangled heaps. The crews of motor-lorries abandoned their vehicles without stopping the engines. The lorries ran amok and finally overturned, thus increasing the confusion twofold."

These operations amounted to an outflanking of the enemy from the air, and his plan for retirement was completely upset. The effect on the moral of the Turks was overpowering. One captured divisional general admitted that he had lost all control of his division, against which he had seen seventy of our machines employed. His statements were substantiated by the testimony of other officers captured as to the havoc wrought by the aeroplane attacks.

In one case a column was broken up eight miles behind the enemy front line. Eighty-seven guns, thirty-three motor-lorries and more than 900 other vehicles were abandoned. Never, probably, was there a more tremendous demonstration than in these operations of the weight and power of the Royal Air Force as a military auxiliary.

The R.A.F. on the Red Sea

The wonderful story of the dominating rôle played by the Royal Air Force in the Palestine victory also gives emphatic interest to the doing of their units stationed at Aden.

Flying over the desert undoubtedly had its picturesque aspect, but the realities of R.A.F. work at Aden were sufficiently grim. Not that the Aden contingent, in spite of active enemy anti-aircraft guns, figured prominently in the casualty lists, —the contrary was the fact—but to all ordinary hazards of flight over hostile country were here added the difficulties placed by Nature in the way of the desert aviator, such as the bewilderment of mirages, the prevalence of sand-storms, and the obstacle of a strong monsoon wind.

Despite these natural hindrances the R.A.F. at Aden performed admirable service in the less spectacular duties of the air, in the way, that is, of reconnaissance, which itself presented

a special difficulty in the desert, where colours merged to uniformity and the white chalk of France gave way to universal yellow.

It was hard to distinguish from the air signs of recent traffic over sand, but British airmen trained their eyes to differentiate with accuracy between the used and the unused track, and their cameras gave them wonderful records.

The Turk could camouflage his trenches easily, but what could not be so readily concealed were his transport and his food supply. The R.A.F. located the Turk by finding his animals.

Camels were observed—transport "cattle and goats were observed"—food; and where transport and food were, there was the Turk in force which could be deduced from the number of his animals.

Reconnaissance was an art of its own on the Aden front, but it was not the whole of the airman's duty. There were the now familiar tactics of ground-strafing and trench-raiding by machine-gun fire from low-flying aeroplanes, and there were bombing expeditions to queer-named bases like Maran, Jalajal, and Waht, where the Turkish Headquarters were raided and bombs dropped on its different buildings. The Sultan's palace in Lahej was bombed successfully; and while the Turkish military establishments were assailed by bombs, Turkish moral was attacked by propaganda leaflets dropped on Waht.

Take it for all in all, the R.A.F. work on the Aden front was a microcosm of their work on the world-front. The special embarrassments of desert flying were overcome, and the R.A.F. got on with its job east of Suez with the same thoroughness and everyday accomplishment of "the apparently impossible and vain" which distinguished its work on all the other widely separated fronts of the world war.

Flying in "Mespots"

The hot weather in Mesopotamia of necessity limited the sphere of activity of the Royal Air Force. Notwithstanding this, many fine long-distance flights were undertaken and valuable reconnaissances and much photographic work performed. Some idea may perhaps be gained of their wide range of action

when it is said that since the conclusion of the Kirkuk operations aeroplanes were employed on various missions at places as widely separated as Samawa, on the Middle Euphrates, and Baku, in Transcaucasia. In fact, wherever troops operated the pilots and observers of the Royal Air Force invariably contributed in no small measure to their success, and their boldness and intrepidity were fully recognised by the Army.

Thus reported Lieutenant-General W. R. Marshall, K.C.B., Commander-in-Chief of the Mesopotamia Expeditionary Force, in his dispatch dated October 1, 1918, of the work of the aviators under his command.

There friendly tribes and hostile Turks were placed on a moving chequer-board of friend and enemy, and communication with the friendlies was often made by aeroplane over unknown country. Nor was it always certain whether the position to which the flight was made was held by friend or foe.

The romance which is associated with the R.A.F. was never more in evidence than on the long flight undertaken over the Persian marches by a daring pilot of the R.A.F.

The aerodrome from which he started was at Kasvin, due north of Hamadan, and his objective was Urmia, on the far side of Lake Urmia, about 200 miles from Kasvin. The exact state of affairs at Urmia was unknown.

The enterprise was carefully prepared, and on July 4 two tenders left Kasvin for Mianeh, some 150 miles from Kasvin, to enable the pilot to fill up with petrol and supplies. The greatest difficulty was encountered on the road, but both tenders were safely at Mianeh by the evening of July 6.

Over Persian Deserts

The pilot landed at Mianeh on the 7th, and it was decided to attempt the flight on the 8th in spite of a strong rumour that Urmia was occupied by the Turks. It was left to the pilot to discover the position as best he could before landing.

He left with important dispatches on the 8th, to return on the 9th if all went well. During those twenty-four hours it was impossible to know what had happened.

The flight from Mianeh to Urmia took about two hours, the last thirty minutes being across the Lake. On arrival the pilot

flew low over the town. His arrival caused much excitement, and about 2,000 rounds were fired at him. It was impossible to tell whether the town was in Turkish hands or not, so he flew over the Armenian Mission and waved.

As the inhabitants waved back in a friendly way he decided to try the effect of flying low over the neighbouring camps. At first the people fired hard, but by means of flying low (at very considerable risk) and waving violently he persuaded them to cease and decided to land.

Landing was no easy matter. The piece of ground said to be fit for landing proved full of holes and hard as iron. Two attempts were made, but the machine ran so fast and far and bumped so much on the bad ground that the pilot had to rise again. On the third attempt he landed safely.

He was received by the Jelus in a very friendly manner as soon as they realised he was an Englishman. The following morning he started for Mianeh, carrying important dispatches from the Jelu chiefs (who had had no certain news since February), and arrived safely at his base at Kasvin.

An Adventure in Persia

Another British pilot left his aerodrome one day in a single-seater aeroplane to act as escort to a reconnaissance machine. Somehow or other the machines lost touch and the escorting pilot flew on alone, following a road. Presently he observed some Turkish troops on the road, and, of course, he dived on them and opened fire with his machine-gun.

Not long afterwards his engine stopped and he was forced to land. He failed to start the engine again, so he did the only thing possible, namely, set his machine on fire.

His position was not enviable, for he was many miles away from any British forces; but he made for the hills and tramped steadily southwards throughout the night. In the morning he reached a small village and decided to trust his fate to an old Persian of benevolent appearance.

It was a risk, of course, but at all costs he must change his clothes and disguise himself as a Persian. Moreover, he was hungry. The venerable old villager, attracted by the promise of 1,000 tomans (about £300), agreed to help, took

the pilot into his house, fed him and kept him there all day. He also gave him Persian clothes and shoes, but insisted on appropriating the pilot's watch and the other contents of his pockets. The pilot's head was also shaved in Persian fashion.

That night they started off together and walked to the neighbourhood of a town, where the guide told the pilot to wait while he went in and bought some food. The Englishman waited some time and presently saw a party of men approaching. Possibly the old guide was a traitor and thought that a Persian reward in the hand was worth two British rewards in the bush. Anyway, the pilot decided not to risk it and made himself scarce.

He was now utterly dependent on his own resources and his disguise. He did not give up hope, however, and started to walk back to the British lines. For four days he tramped doggedly on, during which time all the food he had was six berries and one grape which he picked up on the way. How he blessed the person who had dropped that grape! His feet suffered badly in the unaccustomed Persian shoes. And he was utterly worn out by fatigue, pain and hunger.

At last he struck a main route, and to his unutterable joy met a British cyclist. The man stopped on hearing an English hail from an exhausted-looking Persian tramp. He told the pilot that R.A.F. tenders were coming along the road, and with a feeling of relief and thankfulness the pilot sat down to wait for them.

But he had one more moment of terrible anxiety before his troubles were over. Persian tramps have a way of standing in the middle of a road to stop a British tender, holding up a coin as a bribe to the driver to give them a lift. Drivers soon lose patience with people of that sort; and on this occasion the driver tried to run the pilot down, and all but succeeded. Desperation, however, lent power to the wanderer's lungs, and he managed to make his voice heard above the clamour of the engine. Once the English words caught the astonished driver's ear he naturally stopped—and all was well.

The pilot was none the worse for his adventures, and before long bore no traces of them except a shaven head.

An Air Hunt on the Tigris Front

One autumn morning yet another British pilot was standing on his aerodrome in the deserts of Mesopotamia. His machine, a British scout, was ready near by. The tanks were full and the engine had been tested.

Presently the hum of a distant engine caught his ear. He scanned the cloudless sky and spotted a machine far above him. An enemy too, Turk or German. About 12,000 feet up!

He shouted to the waiting mechanics and mounted into his seat. In less time than it takes to tell he was off the ground and climbing up to catch the audacious intruder. As he had feared, there was no inspiring fight in store for him that day. On the Tigris front the enemy airmen rarely showed fight. This particular enemy was no braver than his fellows. As he caught sight of the British machine he turned for home and put his nose down.

An exciting hunt followed. The enemy had the faster machine of the two; but the Englishman was the better pilot, and he knew by experience the tactics of the enemy in those parts. They almost invariably came over at about 12,000 feet altitude and then turned for home with their noses well down.

The British pilot wasted no time in trying to climb to the same height as the enemy. He simply flew straight in the same direction as the machine above him, trusting to make up for less speed by taking the most direct line of flight. There were no clouds in that Eastern sky which could give cover to the enemy, and pursuer and pursued flew in full view of each other.

Forty miles of yellow desert sand passed below them as they raced. The enemy machine loomed larger as it gradually descended towards the Englishman's level. Now the aerodrome is in sight which may mean safety for the flying foe. But the Englishman is now close on his quarry, and the latter dare not land when thus closely pursued. They are both about 500 feet above the ground now, and the enemy is only fifty yards away. At last the excited but still cool-headed Britisher lets his machine-gun speak. "Rat-tat-tat" go the bullets. The foe tries to dodge, but the pursuer keeps the gun sights on him and keeps up the stream of lead.

A risky flat turn by the enemy takes him out of the line of fire. He must be desperate or wounded to attempt such a manœuvre so near the ground! The British pilot looks again, and the enemy is going down in a steep dive. He lets him go and watches. The enemy flattens out and lands a mile away from his aerodrome. The victor circles overhead and watches, but the enemy pilot does not emerge from his machine. Enough! He won't fly again for some time, even if he ever lives to tell the tale. And if he lives he probably won't want to tell it; for there is little glory in running without a fight and in being caught and shot down by a slower machine.

CHAPTER XII

LAST FLIGHTS OF THE NAVAL AVIATORS

Last Flights of the Naval Aviators—Work of the Fifth Group—The Final Year—The German Defences—Aerial Victories—The Zeebrugge Offensive—Flying Boats—Land Machines—Belgium's Tribute to British Airmen.

CONSOLIDATING the success of the great St. George's Day raid on Zeebrugge by the Royal Navy was one of the innumerable duties carried out by the British naval aviators in the last year of the war. Attacks on the *Goeben* off the Golden Horn, innumerable seaplane duels with enemy aircraft over the North Sea, and a never-tiring anti-submarine patrol which proved the ultimate factor in defeating the enemy's barbarous U-boat campaign, were all invaluable successes credited to the R.N.A.S., or, as it afterwards became, the 5th Group R.A.F.

Work of the Fifth Group

With the institution of the Royal Air Force in April, 1918, the Royal Naval Air Service squadrons operating from the neighbourhood of Dunkirk and Dover were formed into the 5th Group R.A.F. Their identity and personnel, however, were preserved, and they carried on their splendid work up to the signing of the Armistice.

Dunkirk, during the whole war, was the base for aerial operations against the coastal front line, from the Dutch frontier to the Nieuport piers. These operations were much the same as those against a land front line, save that the naval element entered in, as the British side of the lines was, in this case, the North Sea. Photographs were taken continuously; spotting was carried out for monitors by wireless; flights of fighting scouts patrolled the area, and a large amount of bombing was done. From the beginning of stationary warfare until

the final evacuation of Belgium, in October, 1918, the German units on the Belgian coast knew no peace.

The history of these squadrons during the war is one of ever increasing progress and success.

The Final Year

In 1918 the group reached its greatest strength. The night fighting squadrons had been rested and were at their very best when the German offensive in March started. With most of the night and day bombers they were transferred to the battle front, and helped to bring about the marked superiority in the air of the British Air Force on the Western Front. Though the Fifth Group squadrons were but few in number they actually destroyed in 1918 a total of 223 machines, while they shot down another 223 machines out of control.

Night and day bombing continued and was carried out with determination. Zeebrugge, in spite of its formidable defences, was attacked from a height of 200 feet by Handley-Page machines, and a direct hit on one of the lock gates was recorded which put it out of action. Some 1,500 lbs. of explosive were dropped on German positions during this period. Devastating attacks were also made by fifty or sixty machines on enemy aerodromes near the coast.

Many photographs were taken in preparation for the Zeebrugge-Ostend sea raids, and continuous preliminary bombing of these two places was carried out.

The Handley-Page co-operated in the first attempt at blocking Zeebrugge and Ostend, which was cancelled by the seacraft owing to bad weather, though the aircraft carried out to the minute their long and detailed scheme of dropping bombs and parachute flares. On the night of the actual raid, by a stroke of misfortune they were unable to assist in the operations owing to clouds and mist.

When the Belgian offensive started the Fifth Group co-operated with the Belgian Army, and carried out low-flying operations over the enemy positions. They also carried supplies to the advanced elements of the troops during the German evacuation.

During 1918, as in previous years, regular anti-submarine

patrols were carried out by airships operating from the Kent coast, and by the Dover and Dunkirk seaplanes.

The German Defences

All the operations over the Belgian coast during the war were carried out in the face of very strong opposition from the Germans, who built up a powerful and carefully organised system of anti-aircraft defences. There was a very large number of anti-aircraft batteries, including some guns of 8-inch calibre. The famous Westende gun could throw a shell up to 22,000 feet, or over four miles, high. As an example of the difficulties facing the night-bombing airmen, Bruges in particular may be noted. Here, in a small radius, were finally concentrated over fifty searchlights of great power, fifty or more guns of various calibres, about forty kite-balloons carrying nets, and innumerable machine-guns and tracer pom-pom guns.

Aerial Victories

The actual figures of the losses in machines inflicted on the enemy by the aircraft of the Fifth Group will give a vivid idea of the success gained by the British squadrons.

In the period from March, 1915, to December, 1917, the following numbers of enemy machines were accounted for :

Enemy aircraft destroyed	96	
Enemy aircraft driven out of control ...	131	
		227
By Squadrons co-operating with the Army—		
Enemy aircraft destroyed	168	
Enemy aircraft driven down out of control	314	
		482
From January, 1918, to close of hostilities the casualties were :		
Enemy aircraft destroyed	223	
Enemy aircraft driven down out of control	223	
		446
By Squadrons co-operating with the Army—		
Enemy aircraft destroyed	14	
Enemy aircraft driven down out of control	24	
		38
Grand total		1,193

Photos :] [*R.A.F. Official.*

H.M.S. *CANNING*—KITE BALLOON SHIP

The bottom photograph shows how balloons were stowed in the ships from which they were operated. The top picture gives a very good idea of the beginning of an ascent from one of these ships.

Last Flights of the Naval Aviators

The Zeebrugge Offensive

It was after that glorious St. George's Day of 1918, when the Dover Patrol sea units raided the supposedly impregnable German fortifications of Zeebrugge mole and harbour, that the aviators of the Fifth Group best proved their worth.

According to neutral evidence in the Amsterdam *Telegraaf* there were kept thousands of labourers engaged in repair work on the Zeebrugge mole, canal and locks, and in attempts to clear the fairway of the cement-weighted *Iphigenia, Intrepid,* and *Thetis.*

The *Telegraaf* reported that all the repairs which had been carried out at Zeebrugge harbour, mole and locks had been destroyed by airmen, and the canal remained closed. Strive as the Germans would by slave-driving methods to re-establish Zeebrugge as a practicable harbour for their pirate-craft, the continuous air offensive of the R.A.F. maintained the effect of the Navy's excellent work.

Actually the situation grew more difficult for the Germans because sand silted up against the sunken ships and made shoals in whatever remained of the fairway. Each day the heavy keels became more firmly embedded and the chance of their removal grew more problematic.

The Zeebrugge offensive, short and sharp on the part of the Navy, continued by the R.A.F., was a perfect example of collaboration between the senior and the youngest Service. The Navy did the job; the R.A.F. kept its results in being, and, thanks to the R.A.F., all Germany's efforts at repair were so much lost endeavour.

The German dream of England as an island entirely surrounded by submarines never was realised, as we have already shown, because the coastline was entirely patrolled by aircraft.

Flying Boats

We have dealt at length, in previous chapters, with the seaplane and its work, but so far nothing has been said about the flying boat, which was a natural development from it. Flying boats made their first appearance on the East Coast in the early part of 1917, and were used for the same type of work as seaplanes, but had the advantage of greater power and

greater endurance in bad weather. The early form known as the H12 had a rounded hull, but later the big "F" type was produced, fitted with two 350 h.p. Rolls-Royce engines with a V-shaped hull. Like the seaplane, the flying boat could alight on the water, and plans were made for fitting the new craft with hydrophones, so that whilst sitting on the waves their occupants could listen for submarines.

Land Machines

It was not until the submarine menace became exceedingly grave that land machines were brought generally into operation against the U-boats. That was in the early months of 1918. Aerodromes were put up all round the coast, and squadrons established. The types chiefly used were the DH6 and the DH9, though a few squadrons, mostly on the East Coast, used the Blackburn Kangaroo, the EE26 and the DH4.

Nothing perhaps proves more conclusively how very great the British output of aircraft became than the fact that, in spite of the heavy claims of Flanders, Mesopotamia, Palestine and Macedonia, and of the training schools, squadrons of land planes for coastal patrol were established by the dozen during the last year of the war, and never lacked the finest aeronautical personnel in the world in the shape of Royal Air Force flying men.

Belgium's Tribute to British Airmen

Belgium's gallant King, like the army he commanded with so much distinction and success, was the first with his ready and gracious appreciation of the magnificent work of the British flying men in Belgium. King Albert's recognition of the part played by the R.A.F. in freeing his country from the Germans is evidenced in the following communication officially issued by Vice-Admiral Roger Keyes, of the Dover Patrol:

> "The Chief of the Staff of the Belgian Army communicated with the General Officer Commanding Second Army under the impression that the Fifth Group R.A.F. were under his orders. The King of the Belgians, however, asked me to convey to the Fifth Group an expression of

his admiration of the great bravery and skill they displayed in carrying out the task allotted to them under the most difficult and dangerous weather conditions, and his thanks for their services, which were invaluable and greatly contributed to the success of the operations."

The letter from the Chief of Staff of the Belgian Army, referred to in Admiral Keyes' communication, forms a notable tribute to the Royal Air Force. The following is a translation of it:

"I have asked General Sir H. Plumer, Commander of the Second British Army, to convey to you the gratitude of the Belgian Army for the magnificent work accomplished by the Air Force under your command during the offensive launched on September 28. The part played by your aviators in the battle was extremely important; in spite of unfavourable weather conditions your gallant airmen accomplished their tasks with consummate ability, great boldness, endurance and a most sublime spirit of sacrifice.

"They thus greatly contributed to the success of the Belgian Army in its first great offensive.

"We desire to thank you, sir, for your energetic and wise leadership, which ensured the accomplishment of these glorious exploits.

"Please transmit our admiration and gratitude to your heroes, and express to them the most hearty congratulations of the Belgian Army for their marvellous co-operation during the Anglo-Belgian offensive in Flanders."

CHAPTER XIII

THE MAN AND HIS VICTORY

The Last of the British Aces, Major James McCudden—"Our Work"—Deeds without a Hero—McLeod and Beauchamp-Proctor—A Unique Record—Major Barker—The Greatest Air Fight—Captain X—An Australian Pilot's Adventure—Destroying a Zeppelin Shed—A Lucky Escape—The Last Week of the War in the Air—The R.A.F. and the Armistice—Surrender of German Cameras—Ten Months' Work in the Air—The King's Last Tribute.

"Now that the final submission of Germany by the surrender of her fleet and submarines has taken place, the Air Council desire to express their gratitude to all ranks of the Royal Air Force for their share in the long series of operations which have ended so triumphantly for British arms, and their deep admiration for the valour and devotion to duty which has been shown through all vicissitudes.

"In every theatre of war, by sea and by land, the assistance of units of the Royal Air Force has been a factor of ever-increasing importance in the operations of the Navy and Army; in these islands, also, the Home Defence squadrons, under conditions of great difficulty and danger, have successfully met the menace of the enemy's attack by air on the civil population.

"In recent months the work of the Independent Air Force has had moral and material effects which have contributed powerfully to the disintegration of the enemy's capacity for resistance.

"These results are due to the brilliant and inspiring leadership, staff work, and organisation of the Force; to the self-sacrifice and daring of pilots and observers; the unceasing care, under arduous conditions, of the ground personnel; the courage

and devotion of flying instructors at home; and to the ingenuity and industry of all ranks in the equipment branches.

"To all these, as well as to all the members of the Women's Royal Air Force, the Air Council tender the expression of their warmest admiration and gratitude in a spirit of thankfulness for the great results which, from small beginnings, have been achieved by the Air Service; and with the hope and the confidence that, as aviation has shown itself to be so potent a factor in war, so it may also prove itself to be a beneficent influence in the peaceful development of civilisation."

So ran the Air Council's final and official thanks to the Air Services for the great work carried out by British aviators in every theatre of war.

Throughout the history of the war, so far as it relates to the Air Service, it was the personal factor which counted in the great battle for the air, and in the closing stages of the war the difficulty is not so much to make mention of the great British airmen, but to find the necessary space to do justice to all their great deeds. It was ever the man in the British Air Force, not the machine. During the four years of war the aviators claimed no fewer than 15 V.C.s, 235 D.S.O.s, 905 M.C.s, and 287 D.S.C.s.

In addition to gallant James McCudden in those closing stages of the war, there were at least half a dozen British aviators of equal prominence. There was Captain X, the greatest and least known of all. There was Barker, who, single-handed and already dangerously wounded, attacked and drove off a squadron of over forty German machines. Major Raymond Collishaw, D.S.C., D.F.C., destroyed no fewer than fifty-one enemy planes. One morning in the early autumn of '18 with another pilot, Collishaw attacked a German aerodrome and dived five times to fire from a very low altitude on machines brought from a burning shed. He also dropped bombs on the living quarters and shot down in flames an aeroplane arriving at the aerodrome. Lieutenant McNamara, an Australian, after being wounded dangerously in the thigh, swept down through shell-fire to rescue a fellow airman whose machine had been brought down in the enemy's

lines during a bombing raid. McNamara landed about 200 yards from the damaged machine, picked up its pilot, and attempted to fly off. Owing, however, to his disabled leg, the gallant Australian was unable to keep his machine straight, and it turned over. The two officers, having extricated themselves, immediately set fire to the machine and made their way across to the damaged machine, which they succeeded in starting. Finally McNamara, although weak from loss of blood and suffering much pain, flew this machine back to the aerodrome, a distance of seventy miles, and thus effected an unusually daring rescue.

McCudden, a soldier's son, and grandson, enlisted in his father's corps—the Royal Engineers—at the early age of fifteen, and transferred to the Flying Corps after three years of infantry service. He met his death when flying back from leave in England to rejoin his squadron in France. He landed at a depot, and having refilled his petrol tank restarted on his journey. He had not proceeded far, however, when his machine crashed to the ground and he was killed—July 9, 1918.

Major McCudden, who was twenty-three years of age, and had only just been promoted, went out to France with the British Expeditionary Force as a plain air mechanic, and was an observer at Mons. He became a flight-sergeant, winning the Military Medal in September, 1916, for destroying an enemy machine and forcing two others to land. He was then granted a commission in the R.F.C., and in February, 1917, was awarded the Military Cross, and in the following August was granted a bar. Three months later he was awarded the D.S.O. and a bar. In March, 1918, there followed the Victoria Cross, and a little later the Distinguished Flying Cross, while he also received the Croix de Guerre. He was officially credited with having brought down forty-five enemy machines.

McCudden was simply a determined healthy boy with tremendous ideals. There was nothing boastful about his personality. A month or so before he died he wrote to a friend:

"Brought down four of the blighters yesterday. Just luck, you know. We've overhauled them now, and when well led our 'crews' can show them round. . . .

"Send the socks, old bean, by all means, but there's not

much one wants out here. It's all fine sport, and all our fellows will tell you that. It's sport, too, old bean, that is of some national importance. What? See you next leave.

"No! The life is not what you think. It's only the accidents that count. So far as we've met the Huns they do show pluck; but now and again get a taste of the dirty trick—things no Britishers do. Anyway, we are pretty well up with them, and a long way in front in tricks that are clean. How's your Wango? It's nice to have a pet. Shall get a dog of that sort, too, when I come home for good."

"Our Work"

Again he wrote:

"I see the papers are making a fuss again about the ordinary things one does. Why, that's our work. Why fuss about it? I'm so tired, my dear, of this limelight business. If only one could be left alone a bit more and not so much of the hero about it. . . .

"When I come back we'll talk it all over; but nothing doing till then. Look in on the mater and my sisters. You know a fellow cannot say all he feels, and I always want to cry inwardly when I leave home because they look such a lot of things, old chap. Cheer them up when you can, and put a good face on things."

And again:

"If anything happens to me—and you bet it won't if I can help it—be good to mother."

Deeds Without a Hero

Lieutenant Jerrard, V.C., we know from the official reports, after chasing a hostile machine down to within 100 feet of the enemy's lines, single-handed "sat" over a German aerodrome and engaged nineteen enemy machines. But of many a deed of equal daring only the fact remains, the name of the doer has been swallowed up in the fog of war. One was that of a mysterious personality with no rank, known merely as "M——," who came unostentatiously at odd times to various British aerodromes behind the lines, flew off no one knew where, on missions about which they were equally ignorant,

and turned up again in just the same way, perhaps a month or so later.

In another case an aeroplane designer was flying as observer in one of his own machines in order to have personal experience of its working. He was many thousands of feet high when he saw that a couple of wires had broken loose and were swinging in the wind. He got up, took out his camera, and photographed the flapping wires! He said afterwards: "I thought if we crashed and were killed the camera record would tell my friends what had happened."

"There were two airmen, great friends of mine," relates Sir William Orpen, the famous painter, of another such deed, "whose friendship for each other was like that of David and Jonathan. Bright lads both, daring and clever, with some fine exploits to their credit. One of them had occasion to test his machine prior to a night bombing raid. When at a considerable height the machine burst suddenly into flames and crashed to the ground. The pilot's friend, who witnessed the mishap, raced across the ground and plunged into the blazing mass. . . .

"When the flames were extinguished two charred bodies were found. The would-be rescuer was discovered with his arms round the neck of his friend, whom he had heroically, but vainly, tried to save!"

McLeod and Beauchamp-Proctor

There still remains to be revealed the name of the last British ace, Captain X., whom a newspaper correspondent once fittingly described as the "Great Unknown"; and to be told the stories of Major Barker's immortal fight, of the great record achieved by Captain A. Beauchamp-Proctor, D.S.O., M.S., D.F.C., and of Lieutenant McLeod, V.C.

Unfortunately, before the year was out, poor Alan McLeod had succumbed to the wounds he had received whilst gaining his well-merited Cross. When flying at 5,000 feet he was attacked by eight enemy machines, but he enabled his observer (Lieutenant Hammond) to shoot down three of them out of control.

He had received five wounds and his machine was set on

fire, but he climbed out on to the left bottom plane and, controlling his machine, by side-slipping kept the planes to one side, enabling the observer to keep on firing.

When the machine crashed Lieutenant McLeod dragged Lieutenant Hammond, who had been wounded six times, out of the wreckage, and though again wounded he had placed the observer in comparative safety before he fell from exhaustion.

A Unique Record

Captain Andrew Beauchamp-Proctor can claim a record which is perhaps unique in the whole war in the air. During the last four months of hostilities, he was victor between August 8, 1918, and October 8, 1918, in no fewer than twenty-six decisive combats, destroying twelve enemy kite balloons, ten enemy aircraft, and driving down four other enemy aircraft completely out of control. Between October 1, 1918, and October 5 he destroyed two enemy scouts, burnt three enemy kite balloons, and drove down one enemy scout completely out of control in a general engagement with about twenty-eight machines. In the same few days he crashed two Fokker biplanes; he burnt a hostile balloon near Selvigny; drove down, completely out of control, an enemy scout near Mont d'Origny, and burnt a hostile balloon; and on October 5, the third hostile balloon near Bohain.

On October 8, 1918, while flying home at a low altitude, after destroying an enemy two-seater near Maretz, he was severely wounded in the arm by machine-gun fire, but landed safely at his aerodrome.

In all he destroyed twenty-two enemy machines and sixteen enemy kite balloons, and drove down sixteen enemy aircraft completely out of control.

Captain Beauchamp-Proctor's work in attacking enemy troops on the ground and in reconnaissance during the withdrawal following on the battle of St. Quentin from March 21, 1918, and during the victorious advance of our armies, beginning on August 8, has (adds the *Gazette*) been almost unsurpassed in its brilliancy.

He was awarded the Military Cross on June 22, 1918; the

Distinguished Flying Cross on July 2, 1918; bar to M.C. on September 16, 1918; and Distinguished Service Order on November 2, 1918.

Major Barker

Major Barker's rise to fame was equally rapid. He was awarded the Military Cross on January 10, 1917; the first bar on July 18, 1917; the Distinguished Service Order on February 18, 1918; and the second bar to his Military Cross on September 16, 1918. On November 2, 1918, he was awarded yet another bar to his Distinguished Service Order as "a highly distinguished patrol leader whose courage, resource and determination have set a fine example to those around him." Up to July 20, 1918, he had destroyed thirty-three enemy aircraft—twenty-one of these since the date when the last award (second bar to the Military Cross) was conferred on him. Major Barker frequently led formations against greatly superior numbers of the enemy with conspicuous success. But undoubtedly his best performance was his single-handed fight against overwhelming odds. He fought about fifty hostile aircraft, destroying four and driving down another six. He was desperately wounded in the conflict.

Captain X.

Of course that dashing and elusive enigma, Captain X., was none other than the famous Major Edward Mannock, V.C., D.S.O. (two bars), M.C. (two bars), and D.F.C. The official total of victories of this great airman was not announced until after his death, and that after the conclusion of hostilities. This was the British record—greater than that achieved by Bishop, or McCudden or Ball.

Mannock, apart from his seventy-five splendid victories, speedily acquired a great reputation. His great resourcefulness as a pilot and unusual skill with his machine-gun had made his name famous from one end of the line to the other by the end of 1917. Concerning Cambrai, he said in a letter: "We chase the Huns out of the sky with the new 'bus'—the SE5. They won't stand up to it at all. Rotten luck, isn't it?"

He was a member of the 74th, a famous squadron, which

in turn boasted McCudden, Bishop and Mannock as its leader. The greatest British "ace" joined it as a flight commander.

At the outbreak of the war he had been in the Turkish telephone service, but was speedily released, and enlisted in the R.A.M.C. From that corps he was awarded a commission in the Royal Engineers, and then tried for the R.F.C. Though nearly blind in his left eye, he succeeded in bluffing the medical authorities, and in the early part of 1917 found himself in France with the R.F.C.

Mannock achieved extraordinary popularity with the members of the 74th squadron by his unselfishness. It was his custom while leading his flight to manœuvre the German machine into a hopeless position, to leave the *coup de grâce* to some new hand or other, who was zealous to bring down his first enemy machine. At the critical moment, and after the enemy pilot had been rendered helpless, Mannock would turn off, and the novice would dash in and claim an easy victory.

He possessed an astonishing aptitude for fighting at 20,000 feet, and then diving down on to the enemy's back. In one letter, he said: "There were six of us, and we attacked eight Hun scouts. We got six of them, three falling to me. We have lost only six of our original squadron, and have brought down about forty-five Huns. My total is now about forty-one; they gave me the D.S.O. yesterday; I have brought down eight since I was recommended for the D.S.O. If I've any luck I think I shall beat old Mac (McCudden); then I shall try and oust old Richthofen." Alas, a few weeks later he met his death.

He had chased a German scout down from 20,000 feet, and sent him crashing to the earth in flames. Mannock at that time was within 200 feet of the German trenches, and every conceivable kind of projectile was being fired at him. What actually occurred then will never be learnt, but his machine suddenly burst into flames, and without a chance of recovery smashed into the ground, a heap of smoking debris. Some of his comrades cruised around for a little time in the hope of seeing him crawl out of the wreckage, but in vain.

An Australian Pilot's Adventure

An Australian pilot while carrying out an offensive patrol observed a moving train. He swooped down and released two bombs, securing a direct hit near the centre of the train. The rear portion broke loose, and overturned down the embankment. Following up the front portion, which was endeavouring to escape, he poured in 300 rounds from his machine-gun, apparently damaging the engine, for the train stopped, steam escaping from the engine in clouds.

This exploit had drawn the attention of enemy machines. The British pilot first engaged and shot down one German scout. Determined to take no more risks in single combat, seven Fokkers then made a concerted attack upon the British pilot, pouring in a hail of bullets. Almost at once he was wounded, but continued the fight, and one of the Fokkers into which he had fired broke into pieces in the air. By this time all the Australian pilot's ammunition was exhausted, and as he turned for home he was reduced to the expedient of firing Véry lights at the pursuing German machines.

Faint from loss of blood, he actually lost consciousness, and recovering found himself only a few yards from the ground, well over the British lines. By a tremendous effort of will he pulled himself together, flattened out his machine, and managed to make a safe landing.

Destroying a Zeppelin Shed

Two English scout pilots, also during the advance, successfully attacked a German aerodrome at midnight under peculiarly difficult conditions.

A strong wind was blowing at the time, and fierce rain squalls continually swept across the sky. In spite of this the pilots descended to 200 feet, where they released their bombs and obtained four direct hits upon a Zeppelin hangar.

This completed, they noticed another shed which was brilliantly lighted, where apparently important repair work was being carried out under the comforting illusion that the night was too rough for English bombers. Descending yet lower, the two pilots poured burst after burst of machine-gun fire into the shed.

Other lights appeared round the 'drome as the German officers and mechanics hurriedly turned out, and, whilst one English pilot kept guard above, the other circled round and round firing on each light in succession. Then they returned to their own 'drome, flying low all the way, and engaging several groups of German transport and ration parties going up to the line.

The Last Week of the War in the Air

At last it came to the final week of the war in the air. During those last memorable few days, whilst the world waited with bated breath, many thrilling combats and raids took place, of which the following were typical examples.

A British patrol engaged an enemy formation of forty scouts. The leader of the British patrol singled out and attacked one of the enemy aircraft, the wings of which folded up, while its tail fell off and the remains crashed to earth. He was then attacked by a Fokker, but succeeded in shooting it down in flames.

After several indecisive combats, another enemy machine was driven down in flames, and the hostile formation, despite its overwhelming numerical superiority, split up and dived away, closely pursued by the British machines.

During the entire week very few enemy aircraft were seen, but although on three days the weather was bad and visibility poor the British worked unceasingly.

The R.A.F. and the Armistice

The fighting was now all over, and there remained but the surrender of the 2,000 German aeroplanes under the terms of the Armistice. This taking over, examining and packing of so vast a fleet of aeroplanes necessarily took some time, as the German armies, in their retirement, were leaving the machines behind in their evacuated aerodromes. Certain difficulties and attempted evasions connected with the precise proportion of various type of aircraft, and the airworthiness of some of the machines surrendered, had to be adjusted in response to firm representations by Marshal Foch on behalf of the Allies. Some light was thrown upon what this gigantic surrender of aircraft meant to the Germans by the following official British figures

of the air fighting upon the British Western Front from January 1, 1918, to the date of the Armistice (November 11):

Enemy machines destroyed in aerial combat by the British	3,060
Enemy machines driven down out of control ...	1,174
British machines reported missing	1,318

Thus, without counting the heavy air losses inflicted upon the enemy of the formidable French and American air services, Germany was known to have lost well over 6,000 aeroplanes (destroyed and surrendered) during 1918. These figures serve to indicate the overwhelming superiority enjoyed by the Allies in the air at the conclusion of the war.

Surrender of German Cameras

It is further worth noting that the terms of the Armistice included the giving up of the complete equipment of the various reconnaissance and bombing machines, including a large number of German aerial cameras, bomb-sights, machine-guns, wireless transmitters, etc.

The German cameras and bomb-sights, in particular, had long interested the technical experts on these matters in the Royal Air Force. So far as aerial photography was concerned the German lenses had always been of excellent quality (although it was a fact that during 1918 the British produced finer quality lenses than the best that Germany turned out), but the German cameras themselves lacked the many exquisite refinements which marked the latest models of the R.A.F. The training of the German photographic personnel would also appear to have been far less efficient than our own, as the average quality of their aerial prints would not compare with that of the R.A.F. Photographic Section.

The German bomb-sights reflected the singular mentality of the enemy by their complication and the necessity for elaborate calculation by the German pilots and observers in the air.

The outstanding feature of the R.A.F. bomb-sights was that they were designed to eliminate the need for calculation by the pilot, all the necessary computations being made auto-

THE VOICE FROM THE CLOUDS

The wireless telegraph apparatus, by which the aeroplane can speak to the gunners many miles away from the target over which it is flying, has made "spotting" from the air a very deadly business. The top picture shows the small air-screw-driven dynamo behind the propeller. This makes the current to work the wireless. The bottom picture shows the apparatus in place in the plane, including, underneath the shelf, the wheel on which the antennæ is coiled.

matically by simply adjusting the sight to the speed at which the machine was travelling. There can be little doubt that the accuracy of the British bombing, which had been so markedly superior to that of the Germans, was very largely due to the effectiveness of these sights.

The Royal Air Force had nothing to learn from the surrendered German wireless transmitters. The British machines had been fitted for many months with installations which not only perplexed but aroused the envy of the Germans. So demonstrably was the R.A.F. wireless superior to that of the German Air Service that General Ludendorff, in an official Order issued in June, had offered a substantial reward for the salvage of any part of a British wireless set from British machines brought down within the enemy lines.

Ten Months' Work in the Air

The extent to which the final victory of the Allies was due to the less spectacular aspects of R.A.F. efficiency has never fully been appreciated. Public interest naturally centred in the brilliant and often sensational exploits of our fighting airmen, rather than in the more prosaic, routine work of the R.A.F. The immediate results of this fighting were indeed very striking, as the following figures for the period January 1 to November 11 show:

Enemy machines destroyed by R.A.F. on British Western Front, and in Italy, Macedonia, Palestine and Mesopotamia	3,539
Enemy machines driven down out of control by R.A.F. in above theatres	1,251
British machines missing	1,420

It should never be forgotten, however, that all this fighting was primarily undertaken to enable other and even more vital work of the R.A.F.—such as strategical reconnaissance (including photography), contact patrol, and bombing—to be carried out.

As an illustration of the magnitude of these little recorded aspects of Royal Air Force routine, it may be mentioned that from January 1, 1918, no fewer than 264,605 R.A.F.

negatives were taken in the air over German territory on the Western Front alone. From these negatives the gigantic total of over 5,800,000 prints (each one being separately enlarged) were made for the use of the General Staff. During the same period 5,429 tons of bombs were taken into the air by Royal Air Force machines and dropped upon military objectives behind the German lines, while a literally incalculable number of observational flights were made for the purpose of spotting for artillery and maintaining contact with our troops.

The King's Last Tribute

Immediately on the signing of the Armistice, His Majesty sent the following message to Lord Weir, the Secretary of State and President of the Air Council :

"In this supreme hour of victory I send greeting and heartfelt congratulations to all ranks of the Royal Air Force. Our aircraft have been in the forefront of the battle; pilots and observers have consistently maintained the offensive throughout the ever-changing fortunes of the day; and in the war zones our gallant dead have lain always beyond the enemies' lines or far out to sea.

"Our far-flung squadrons have flown over home waters and foreign seas, the western and Italian battle lines, Rhineland, the mountains of Macedonia, Gallipoli, Palestine, the plains of Mesopotamia, the forests and swamps of East Africa, the north-west frontier of India, and the deserts of Arabia, Sinai and Darfur.

"The birth of the Royal Air Force, with its wonderful expansion and development, will ever remain one of the most remarkable achievements of the great war.

"Everywhere, by God's help, officers, men and women of the Royal Air Force have splendidly maintained our just cause, and the value of their assistance to the Navy, the Army and in Home Defence has been incalculable. For all their magnificent work, self-sacrifice and devotion to duty, I ask you on behalf of the Empire to thank them.

"GEORGE R.I."

CHAPTER XIV

WHY GERMANY LOST THE AIR WAR

Why Germany Lost the Air War—Decline of German Air Service—Shortage of Battle Pilots—Other Reasons for Germany's Aerial Defeat—Gradual Loss of Moral—Germany Feels the R.A.F.—Material Worth More than Life—"Auf Fliegerschutz"—Evidence of Returned British Prisoners—A Mistaken Air Policy—Reventlow on British Motives—British Airman's Experiences in German Prison—Germany's Misleading Air Claims—German Fears—Failure of Punitive Raids—Rittmeister von Richthofen—A Prophetic Document—The Last Dramatic Encounter—Recovery of the Body—Identification—An Impressive Funeral.

BEFORE proceeding to answer this vital question, one important factor must be considered. In the matter of the air war, the general situation must be considered quite apart from the Flanders battle situation. The enemy lost the war in the air some months before their invading armies were driven by the British out of Belgium. Why?

Out of many, two reasons predominate. Throughout the five years of war the German air commanders followed the wrong policy. They allocated to aircraft too great a military value, at the expense of an invaluable moral quality, and this strategic blunder reacted on their own ranks. During the closing stages of the war the moral of the German Air Service was far from what it should have been.

Decline of German Air Service

It would seem that moral in the German Air Service began to crumble much more rapidly than their army moral generally, after the first appeal for an armistice. This was perhaps natural, having regard to two important factors: (1) The deadly influence in aerial work of any shortage or deterioration in equipment and raw material of construction; (2) the fact that

in an air service the standard of moral required for successful work was exceptionally high, because so very much depended upon individual initiative, outside the observation of superior authority.

A number of German prisoners interrogated on one day gave interesting evidence on various points about the German Air Service.

The losses due to bad landings, for example, were described as very heavy, especially in training centres. A mechanic, who was at the Second Pursuit Flight School for six months during 1918, stated that in ten weeks 243 crashed machines were sent to Germany from this school alone, and during the six months he was there the average number of crashes per day was eight.

Shortage of Battle Pilots

About July, 1918, there was a dangerous shortage in Germany of pilots for scout machines, and pilots were compulsorily transferred to pursuit flights from other types of units, or if coming from training squadrons, were not allowed to go to two-seaters.—It should be noted that pilots formerly always volunteered for scout units.

This situation was said to have arisen from the fact that reports of enormous casualties in pursuit flights had been circulating in the German Air Service, whereas previously they had been considered very "safe" units, and had even been dubbed "life insurance companies."

There was also a marked shortage of certain types of machines. With regard to personnel an attempt was made to meet the shortage by compulsorily transferring Zeppelin mechanics to the aeroplane service for training as pilots.

The shortage of petrol, already reported by prisoners in reconnaissance and battle flights, was also beginning to be felt in pursuit units. Pursuit flights in the Sixth German Army were allowed to fly for an hour only every other day, and pilots were not permitted to carry out independent patrols.

To sum up, there was a shortage of machines, men and petrol, while the continuance of bad landings, especially at training centres, showed that training was now quite inadequate.

Why Germany Lost the Air War

Other Reasons for Germany's Aerial Defeat

But an even more potent cause of Germany's aerial defeat was the long series of disasters now endured by her battle aeroplanes, also the loss of so many of her leading aviators, and particularly the loss of von Richthofen. It is said, in fact, that the German Service was never again the same after the death of von Richthofen.

The "star" pilots of the German Air Service, whose achievements were widely boomed in the German Press, had to pay heavy toll to the later superior fighting, initiative and skill of the British battle airmen. Taking as "stars" all the German pilots credited with more than twenty air victories, it can be stated definitely that in 1918 alone fourteen, with an aggregate of 363 victories between them, were killed or captured. Included in this fourteen is that star of the first magnitude Captain von Richthofen (seventy-nine victories claimed), Lieutenant Max Muller (thirty-eight victories), and other leading pilots. To the Allied airmen who put out of action such expert opponents the highest possible credit is due, for the German stars usually preferred to operate accompanied by a picked body of air fighters (the well-known "Circus"), and the circus had to be located behind the enemy's lines. Not that the German airman lacked initiative and resource, but the superiority of the Allied aviators in these qualities led him to adopt tactics of a more stay-at-home order.

Gradual Loss of Moral

Though temporary in effect the loss of a German star airman invariably produced a period of diminished moral in the German flying service. This loss of moral was all the greater because of the German practice of singling out individual pilots by name for constant mention—a practice which Britain avoided both in order to encourage the corporate spirit of "playing for the side," and in order not to do injustice to the equally brave and meritorious, but less spectacular work of pilots and observers, who were engaged in reconnaissance, photography, artillery observation and bombing. The circuses, it is true, remained in being, and, after a period of comparative quiescence, took the air once more under new leaders. But

even the most enthusiastic and daring substitutes necessarily took time to inspire the feeling of confidence, which was essential for every member of the troupe, if the circus was to be a success.

Germany Feels the R.A.F.

The German infantry behind the lines suffered in equal proportion to the air service from the daring and merciless attacks of the British bombing airmen; as also did the civil population of the Rhine towns from the bombs of the Independent Force. The British campaign of intensive bombing achieved one of the greatest moral victories of the war in the air which Germany had to face. In the end all that appeared to occupy the thoughts of the enemy's infantry was how to escape the bombs of the Allied airmen. A series of letters taken from captured prisoners indicates something of the condition to which the Germans were reduced.

October 23: "All day long, on account of the enemy planes, we have to sit in our little 'fox-holes,' covered by a shelter, and wait for night when we can move a little. If the location of our position becomes known to the enemy, instead of getting into our dug-outs, each one takes his pack and moves on."

September 18: "We have hauled forward new guns by hand from the railway. The railway cannot be used for transportation purposes, because the station at Longuyon, where we were detrained, has been destroyed by aviators."

An Army document of October 13 indicated a shortage of lubricants which must have seriously crippled the German Air Service. "According to a memorandum from the Line of Communication No. 5 lubricating material for the month of October cannot, in all probability, be supplied."

This shortage of supplies was further emphasised by a sharp Army Order of October 7. "Owing to the lack of raw materials and in order to further the manufacture of munitions, it is the urgent duty of all concerned, even in periods of sharp fighting, to continue the evacuation of all empties. No vehicle returning from the lines will go empty; every convoy leader, every driver is enjoined to haul such material back."

Material Worth More than Life

Material, in fact, by this time was worth more than life in the German Army. Only one visualises it in its last stage paying explicit attention to the order to evacuate all empties, "even in periods of sharp fighting." It can hardly have been a finely disciplined army when, to quote again: "The rolling kitchens were moved back on account of heavy air bombardment. As a result the men received no food during a day and a half."

The nomadic existence of German air squadrons was indicated by the fact that whenever the Richthofen squadron moved, it carried small tents to house the machines in case there were no hangars. It might be added that only by frequent moves did the German Air Service succeed in taking the air at all in any force, and to find its crack squadrons driven to the snail-like expedient of carrying its home with it, was a striking comment on the condition of the service as a whole.

A prisoner stated of his Flight, that it "has six crews but only four planes. Replacements do not come in. The flight had enormous losses; only one of the pilots remains, all the others being replacements who have not flown ten times on the front."

A telling footnote to the last statement was afforded by a captured flying officer whose "aviation training consisted of two months in one school and two weeks in another before he was sent on active service."

Thus the German Air Service was defeated, and their defeat resulted in the R.A.F. ascendancy which caused such demoralisation to the bombed German Army, hungry and apprehensive in their fox-holes.

Yet another evidence of this British aerial ascendancy was the enemy's ubiquitous provision of air-raid shelters and extensive ranges of underground dumps and stores in his back areas, while inside the German frontier this apprehension was even more pronounced. For instance, the following from the *Trierische Landerzeitung:* "At a sitting of the Treves City Council on June 12 the Oberburger-meister made the following statement about air-raid defences.

"'It has been rumoured that the anti-aircraft defences are

not as efficient as formerly, that munitions are being economised, and that the A.A. guns do not fire when German aeroplanes are in the air.'

"The Oberburger-meister was here interrupted by a Councillor who stated that bombs had fallen in a railway junction just outside Treves before a single shot had been fired by the anti-aircraft guns. Another councillor complained that people were put in an unnecessary state of alarm by air-raid signal practice which took place daily."

It is worth pointing out that not more than two British air raids was the cause of all this tribulation at Treves.

"Auf Fliegerschutz"

The construction of the innumerable air-raid shelters behind the firing lines must have cost the Germans an enormous amount of labour and diverted a large amount of energy to this non-productive occupation. Every town and village for many miles behind the line which the Germans held was absolutely plastered with such notices as "keller fur 10 Mann," "Fliegerdeckung fur 20 Mann," "Fliegerschutz," or "Zum Unterstand."

Every little house or cottage having the merest pretence of a cellar was carefully labelled with its holding capacity. And where, for the space of a few yards, no such cellars were available, large arrows pointed in the direction of the nearest shelter, so that the infantryman might not be forced to lose valuable time, while British aircraft were above, in looking for a refuge.

At the first indication of any British aircraft being in the vicinity all the Germans billeted in the town or village would scurry like rabbits to earth, filling the cellars and bomb-proofs, and leaving the civilians to fare as they might up above.

Evidence of Returned British Prisoners

These facts, moreover, were borne out by returned British prisoners who were working in this area. Two such released prisoners said they had been made to work hauling wagons near Mons. Every time our planes came over—and in anything like possible weather it was usually several times a day—all the Germans, including their guards, would rush for cover.

They said that the advent of the British bombing planes was the only thing they had to look forward to during those dreary days. It provided them with endless amusement to see the terror of the panic-stricken Germans. Each morning the thought of these prisoners was, if the weather was fine: "Well, our boys will be here to-day."

German Fears

"The numerous hostile air raids on back areas will increase as the enemy augments his air forces. Whereas air raids are at present of short duration . . . we must take into consideration the possibility of future air raids lasting for hours, thus making work as well as rest impossible."

The above is not a British report, but is an extract from a German Army order signed by von Bülow, a copy of which was captured by the British. It bore incontrovertible witness to the immense moral and material damage produced by the bombing raids of the Royal Air Force, and to the well-founded German fear of worse to come in the future.

"It is not sufficient," the order continued, "to use neighbouring dug-outs simply as cover from attacks of short duration. Troops must accustom themselves, even in rear areas, to sleep and work underground both by night and, when necessary, by day. This will entail heavy work, especially when much concrete has to be used. In their own interests troops must make a start at once on the work.

"Roads are frequently machine-gunned and bombed, especially at night, from low heights," the order complained. Then it proceeded to outline more elaborate measures of defence which were prefaced with the remark that: "the enemy fires at aircraft more than we do. The fear of giving away the machine-gun emplacements prevents our men from opening fire." The German stands as his own accuser. Where were all his countless aircraft while all this was taking place?

Lest the Germans, with nerves overstrung by frequent bombing from British machines, should fire on their own aeroplanes, the order added the proviso: "Fire may be opened only under the orders of an officer."

In an endeavour to hearten the harassed German troops, the

order informed them that, "the number of anti-aircraft guns is to be increased." But the effect of this is rather spoilt by the qualifying addition that: "It cannot be hoped that we shall be able to keep pace with the increase in enemy machines!"

Von Bülow wound up by administrating yet another cold douche to his already badly chilled troops: "The best means of defence against enemy airmen are our scouts, which are also being steadily reinforced. Their numbers will, however, never equal the enemy's strength in fighting numbers!"

Failure of Punitive Raids

Even their campaign of punitive air-raids against Great Britain failed the German air commanders in the closing stages of the war. After their highly successful raid on London and the south-east coast by over thirty aeroplanes on October 31, 1917, there were only another thirteen made by heavier-than-air machines, while four further Zeppelin attacks completed the quota.

Rittmeister von Richthofen

It is impossible, finally, to exaggerate the effect of von Richthofen's death on the German Air Service. It was a blow to the moral of the enemy aviators from which they never really recovered. For this daring, skilful battle airman was admitted, by friend and foe alike, to be the greatest of the war. The idol of the German public, the admired of the All Highest, and victor in seventy-nine aeroplane contests, von Richthofen was shot down on Sunday morning, April 22, 1918, while flying low inside the German lines. He was trying to break down our aerial defences in the Ancre region in order that the enemy reconnaissance machines might get through and across the line. The bullet that killed him was probably fired by a Lewis gunner attached to a battery of Australian Field Artillery.

A Prophetic Document

Under the circumstances, an amount of interest centres in a certain document captured by the Allies on the same day as the great German airman's death. This was a communica-

tion from a "Group Commander of Aviation" to the "First Pursuit Squadron," Richthofen's own squadron, which said: "It is not possible to fly over the Ancre in a westerly direction on account of strong enemy opposition. I request that this aerial barrage be forced back in order that a reconnaissance up to the line Marieux-Puchevillers—ten miles behind the front—may be carried out." It was at eleven o'clock on that Sunday morning that von Richthofen's squadron appeared over this same area, over the British lines between the Somme and the Ancre, not far from Corbie.

The Last Dramatic Encounter

Richthofen fell at the end of a severe fight between British and German squadrons. He was shot down while flying a triplane very near to the ground, and himself chasing down a British scout. It proved a regular dog-fight, at the end of which the German champion crashed, smashing his machine to smithereens.

The fight began when two Australian aeroplanes, out well behind the German lines, suddenly met six enemy machines above them. The Germans dived immediately to attack, sitting on our men's tails. The Australians, turning and firing over their tails, caused one of the enemy triplanes to fall apparently out of control. The Australians themselves went down in order to escape. Eventually recovering, they found themselves out of a battle which was proceeding over the Somme between about fifteen aeroplanes on each side. A British squadron of fighting scouts had engaged an enemy squadron, whereof the Australians evidently had only met a part. Four German triplanes were shot down, but none of the British machines. It was not recognised until Richthofen's dead body was identified that this was his famous "Circus." The identification was clear from papers and the watch of the fallen aviator.

Recovery of the Body

The enemy guns immediately put a heavy barrage around the crashed and notorious crimson triplanes, perhaps with the intention of trying to rescue the body after nightfall. Some of our men, however, crawled out at great risk to themselves and

found that Richthofen had been instantly killed. They placed a rope around his dead body and pulled it into a trench. The bombardment continued, and the remains of the Fokker could not be salved until some hours later.

Identification

Richthofen had been shot through the chest, the bullet entering the left side and coming out on the right, and there was a wound on the face, apparently caused by the fall. He was a clean-shaven, good-looking young man under thirty, with light hair and a well-shaped head. He wore a Sidcot flying suit, but no uniform, and in the pockets were a number of documents, including a pilot's certificate endorsed with the record of his many victories in the air, and a gold watch with his crest and initials. The triplane, No. 2,009, was fitted with new La Rhône motors, made but a month previously at Oberursel Aviation Factory, near Frankfort, and two Spandau machine-guns synchronised to fire through the propellers. His machine was light but extremely powerful.

An Impressive Funeral

The Royal Air Force authorities took charge of the body and placed it in a cloth-covered coffin made by their mechanics, with a plate on the lid bearing the name: "Cavalry Captain von Richthofen," with the date of his death. The funeral, which took place at five o'clock in the evening of the following day, was a very impressive ceremony. Escorted by a detachment of troops, the body was conveyed to a little French cemetery, a journey of a mile and a quarter. There were many wreaths on the coffin, and one bore the inscription: "A Valiant and Worthy Foe." Six officers of the Flying Corps acted as bearers.

The procession passed slowly along a country road, saluted by hundreds of soldiers, and even in the camps far across the meadows men could be seen standing at attention. A firing-party paid him the last tribute of his enemies, as British aeroplanes circled overhead. With that simple coffin, it might well be said, were also buried all the once glorious hopes of the vaunted German Air Service.

CHAPTER XV

THE INDEPENDENT FORCE

The Highest Form of Aerial Warfare—Major-General Sir Hugh Trenchard, K.C.B.—Kaiser Escapes from British Bombs—Preparing the Way for the I.F.—Bombing—Bomb-sights—Bombing Squadrons—Night Bombing Raids—Subsidiary Services—French Co-operation—Trenchard's Policy—Value of Day Bombing—German Railways the First Objective—I.F. Reinforcements—Adverse Conditions—Triumph over Difficulties—August Records—Three Months' Activities—Metz-Sablon and Thionville—Mannheim—Heavy German Losses—Another Record Month—September Raids—An Historic Phase of the War—Trenchard's Praise of His Men.

It is only right that the last matter to be dealt with in this history should be the Independent Force, R.A.F. Barely five months old at the time of the signing of the Armistice, the I.F. was the highest attainment of aerial warfare.

The aim of this splendid force was to carry the war in the air into the heart of the enemy's country. That is to say, it was the first independent strategic effort of the aerial arm. Hitherto, invaluable as had proved the work of the R.N.A.S., R.F.C. and, afterwards, the R.A.F., the air war had been subordinate to, and always followed, the main naval and military objective. The formation of the Independent Force, R.A.F., in the early summer of 1918, lifted aerial warfare into a plane of entirely different aspect. For here was a force working independent of either Navy or Army, or their respective commanders, with the precise object of carrying on the war beyond the trenches, to the third and fourth lines of defence, even beyond the enemy's own frontiers.

As Major-General Sir H. M. Trenchard, K.C.B., the Commanding Officer, remarked in his final dispatch concerning the work of the I.F. in its brief five-months career: "I took over from Field-Marshal Sir Douglas Haig the tactical

command of this Force on June 5, and the administrative and complete control on June 15, 1918."

It was in May of that year that Lord Weir, the then Air Minister, by the permission of the Imperial War Cabinet, first considered it "advisable to constitute an Independent Force to undertake the bombing of the industrial centres of Germany." It may be remarked in passing that Britain was the only one of the belligerent nations to achieve this highest form of aerial warfare. From that date on the British Air Force was to rank as a service separate from either Navy or Army. Major-General Trenchard wrote—May, 1918—it was "intimated to me that you intended to place the whole of the British effort in attacking Germany from the air under my command, and that it would be probable that squadrons would be available to carry out this work from England as well as from the eastern area of France."

Major-General Sir Hugh Trenchard, K.C.B.

It was a very satisfactory and popular appointment. The career of Sir Hugh Trenchard was as unique as the history of the new Service he was so ably to command. He was the man to whom Britain's best thanks are due for her glorious victory in the air. Primarily responsible for the amalgamation of the R.N.A.S. and the R.F.C.—the most valuable aerial development of the war—he organised and first commanded the Independent Force, R.A.F.; and in January, 1918, was appointed Chief of the Air Staff and a Member of the Air Council. General Trenchard's military career is as romantic as that of Sir William Robertson, even of the great K. of K. himself. After a brilliant military career in South and West Africa, at the outbreak of the war he became Commandant of the Military Wing of the R.F.C. But his record year was in 1915. During nine months he obtained no fewer than three promotions; January 19 to Lieutenant-Colonel; June 3 Colonel; and in the autumn Brigadier-General. By June, 1916, he was a temporary Major-General, and had been appointed A.D.C. (extra) to the King.

Kaiser Escapes from British Bombs

On two occasions the Kaiser narrowly escaped destruction at the hands of the Air Force!

The Independent Force

On Christmas Eve, 1917, No. 55 Squadron was carrying out one of its regular raids on Mannheim. Among the objectives was the railway station, which was wrecked by several heavy bombs. Only fifty minutes before the bombs fell the Kaiser and his staff, en route from the Verdun front to Berlin, had passed through the station, the Imperial train being, as a matter of fact, the last train through.

The second escape took place as late as May 7, 1918. Between 4.35 and 4.50 twelve machines from No. 55 Squadron attacked the main station and the railway triangle at Metz Sablon. Five bombs fell on the station and others in the station square, on the tracks, and the goods sheds. Investigations made since the armistice proved that the loss of life was very great.

A "High General" was expected, a guard of honour had been paraded at the station, comprising infantry and cavalry, and a large crowd had assembled to witness the ceremony. The "High General" was no other than the Kaiser himself.

Fortunately for the Kaiser the alarm had reached him in time, and his train was stopped at Thionville, only sixteen kilometres distant, and he and his suite hurriedly took cover.

Preparing the Way for the I.F.

The time of the Kaiser's last escape was a time of great development for the British bombing squadrons. In fact, the period of intensive bombing may be said to have begun October 11, 1917. Then was formed and stationed in the Nancy area the 8th Brigade R.A.F., under the local command of Brigadier-General C. L. N. Newall. This Brigade consisted of:

No. 55 Squadron, De Hav. 4, 275 h.p. Rolls-Royce;

No. 100 Squadron, F.E. 24, 160 h.p. Beardmore;

No. 216 Squadron, Handley-Page, 375 h.p. Rolls-Royce;

being afterwards joined by No. 99 Squadron, De Hav. 9, 200 h.p. B.H.P.

From October 11, 1917, to June 5 this small force, in spite of a very severe winter, carried out no fewer than 142 raids. Forty-seven of these raids were made in Germany, and included night and day attacks on Cologne, Stuttgart, Mannheim, Mainz and Coblenz. Long-distance raids were also carried out against

Namur, Charleroi and Liége, in order to help in attacking the enemy's communications on the Western Front.

It should be remembered that No. 216 Squadron (at that time R.N.A.S.) was hastily formed, and was not equipped until October, 1917. No. 100 Squadron was only equipped with short-distance machines, and No. 99 Squadron only joined in May, 1918.

No. 55 Squadron was equipped solely with short-distance machines, which had an air endurance of three and a quarter hours only. But the squadron itself rectified this to the best of its ability by adding extra petrol tanks to the machines, which gave them an air endurance of five and a quarter hours.

The work during the winter called for exceptional efforts of endurance and perseverance on the part of the commanders, pilots and observers.

Preparatory work on the construction of aerodromes with a view to accommodating a larger force had been undertaken before Sir Hugh Trenchard's arrival, and had been handled with zeal and tact by the General Officer Commanding the 8th Brigade. The work accomplished by General Newall formed a foundation upon which he was at once able to build in making arrangements to accommodate an increased number of squadrons.

Bombing

At this stage it may be pertinent to inquire: "What was bombing?" And to answer that question satisfactorily, the historian cannot do better than to start with the bomb itself; to explain the manipulation of the sights which governed the passage of bombs dropped through the air; the objectives of bombing by night and by day; the peculiar formation of the bombing squadron when at work; the necessity of escorts of faster machines, and one of the most interesting phases—bombing from a low altitude.

Bombs

To begin: Bombs were of many sizes and shapes, those most in general use ranging from the 40-pounder to the 600-pounder. The former was about eighteen to twenty-four inches

in height, the latter nearly as tall as a full-grown man. No fewer than fifty-six of the 40-pounders went to a ton, while four of the latter just exceeded that weight.

The ordinary large British bombing machine carried three tons of bombs, equivalent to eleven of the 600-pounders; the ordinary trench-strafing machine, fitted for the purpose with bomb-racks, taking from four to eight of the 40-pounders.

The bombs were not "live"—or ready for action until they were released from the racks. This action set free a vane, which revolved rapidly as the bomb fell through the air, thereby bringing into position the striker, which, as a result of the violent concussion caused by striking its objectives immediately exploded the charge. This was the contact bomb. Another type was set to explode some times after reaching and penetrating the object.

The effect of a 600-pound bomb was to demolish a big building, but very considerable damage could be caused by a 40-pounder. This can be seen by an instance of which the writer received positive information from an eye-witness. Two 40-pound bombs were dropped. The first landed in the middle of about twenty motor vehicles which were packed close together. Four of the cars were completely wrecked; six or eight more were very badly damaged, especially as regards the engines, and the remainder were punctured and knocked about by flying splinters. The other bomb fell exactly between two hangars each containing five machines. All of them were so badly damaged as to be quite useless. As a result of the damage the squadron had to be withdrawn from its forward position to be refitted. This is a typical instance of the great damage which could be done by only two small bombs carefully aimed.

Bomb-sights

But these few facts convey to the reader little idea of the difficulty of dropping a bomb from a machine flying at anything from sixty to 100 miles per hour, to hit a target anything from 1,000 to 18,000 feet below.

The speed of the machine, its height, and the wind pressure of the moment all had to be taken into account to ensure accur-

ate bomb dropping, and to estimate and counteract these factors scientifically devised bomb-sights were provided.

It will be realised, for instance, that the speed of the machine would give a big forward impetus to the bomb as it fell, so that it was necessary to drop it a considerable distance before the target was reached. At very low altitudes the use of bomb-sights was not so essential and much could be done in the way of accurate dropping of the "eggs" by the unaided judgment and experience of pilot and observer.

The bombing sights used by British airmen were extraordinarily good and accurate in the results they gave, and the haphazard, promiscuous unloading of bombs of which German airmen gave so many examples was unknown in the R.A.F. The pilot or observer, having set his sight before he reached his target, flew over it once, if possible, before dropping his bombs, and calculated, by means of his instrument, the distance from his target at which they should be released.

Then he banked round and again made for the object of his visit—perhaps a hostile aerodrome. At the right moment he pulled over his release levers and his "eggs" were laid.

Far below, several seconds later, puffs of smoke and spurts of flame on and around the hangars showed that the "eggs" had been hatched.

Bombing Squadrons

The regular bombing squadrons were used purely and simply for bombing purposes, and did no other work, except to take photographs of their own targets, before and after strafing. Every fine day and night, and often in bad weather too, they were engaged in dropping incendiary and high explosive bombs on German billets, ammunition dumps, stores, aerodromes, railways, factories, and, in fact, on anything the destruction of which was likely to hinder the enemy's work in the field.

There were two classes of these squadrons: those that flew by day and those that flew by night. They did very similar work, but the type of machines used and the methods of working were entirely different.

Day bombing squadrons had not only to be able to bomb, but, since they were very likely to be attacked by hostile air-

craft, they had to be able to defend themselves. Therefore it was essential that a day bombing machine had to be powerful in order to carry the necessary weight of bombs whilst at the same time it had to be fast and able to manœuvre and to climb quickly to a great height. The British had a very excellent type of machine which answered all these requirements, and thus in this particular branch of aerial work they established a marked ascendancy over the Germans.

Then, too, for defensive purposes, a day bombing squadron had to fly high and in formation; consequently they had generally to bomb their objectives from a considerable height. With the latest type of bomb-sight fitted, however, this did not hamper them in obtaining direct hits, whilst the fact of flying in formation under an experienced leader ensured all the machines reaching the objective.

Night Bombing Raids

For night work a fast machine was not essential, and, in fact, a steady, stable machine possessed great advantages, being much more easy to land without mishap in the event of a forced landing. Also such a machine required low flying, and thus gave the pilot more latitude for consulting his map and fixing his course.

It was not essential to fly high at night. A large stable machine had been designed, which was capable of carrying a very heavy load of bombs and enough petrol and oil to keep the machine in the air for many hours. Accurate bombing at night was not nearly so difficult as one would imagine. It could be safely carried out from a very low height, and given an average clear night, with the aid of luminous bomb-sights, direct hits were frequently obtained by the British airmen.

Formation flying at night was not aimed at as navigation lights would be necessary for it, and those, if used on the German side of the lines, would give the position away. A certain amount of leadership was, however, possible. The leading machine, which was flown by an experienced night pilot, took off first, the other machines following at short intervals. After crossing the lines at a pre-arranged point, the leader used certain signals at intervals all the way to the objective,

thus ensuring that less experienced pilots should not lose their bearings.

Night bombing squadrons had an advantage over day squadrons in the comparatively safe use of their machine-guns. Once they were rid of their bombs they were able to fly very low and strafe trains, transports, billets, searchlights, etc., with extremely telling effect.

Subsidiary Services

These, then, were the main activities of the units which General Trenchard now formed into the Independent Force. But the latter Service was not yet complete. In aviation it was also essential that the technical and administrative controls should be under one command, as the work to be carried out nearly always depended entirely on the administration of the force. As it had been decided to separate the tactical control of this Force from the British Armies operating in France, it was therefore necessary to separate the administrative control as well; and it likewise became necessary to constitute all the administrative services on an independent basis, in order to make the Air Force completely independent.

This involved the formation of a large staff to deal with the multifarious matters connected with the formation and the maintenance in the field of an aerial force.

In addition to this, the Anti-Aircraft Defence and Searchlights came under General Trenchard's command.

By June 26 the staff for the above-mentioned services had been assembled and organised and were capable of maintaining the Independent Air Force.

French Co-operation

The Independent Force at this time was operating in the zone of the group of the French Armies of the East under the command of General de Castlenau, who eagerly offered every assistance to their new commander. While the administrative services were provided by Field-Marshal Haig from the British Armies in the field, the British Armies in the north provided all the personnel and material necessary to maintain and organise and operate the new Force, apart from technical aeroplane supplies.

The Independent Force

Sir Hugh Trenchard's first object was to push on at once and arrange for the accommodation of a Force in the neighbourhood of sixty squadrons. This was a much harder task than it might appear at first sight.

The country was throughout hilly and woody, and where there were any level places they consisted of deep ridge and furrow, there being as much as three feet six inches between furrow and ridge.

The aerodromes had to carry heavy machines and heavy bomb loads; in order to enable this to be done draining work on a large scale had to be very carefully carried out, and arrangements had to be made for a large installation of electrical power for workshops and lighting and petrol in order to save transport.

This work was practically completed by November 1, 1918.

Trenchard's Policy

An even more important matter for the Commander of the Independent Force to decide was general policy. General Trenchard adhered to the "necessity for equipping the British Expeditionary Force on the Western Front with sufficient aircraft to hold and beat the German aerial forces on the Western Front; that the bombing of Germany was a luxury till this had been accomplished, but that, once this had been accomplished, it became a necessity." That is to say, it became necessary to attack "the German Army in Germany, and to strike at its most vital point"—its sources of supply; and the Independent Force was formed with this object.

"The question I had to decide," said Trenchard, "was how to use this Force in order to achieve the object, i.e. the breakdown of the German Army in Germany, its Government, and the crippling of its sources of supply.

"The two main alternative schemes were:

"1. A sustained and continuous attack on one large centre after another until each centre was destroyed, and the industrial population largely dispersed to other towns, or

"2. To attack as many of the large industrial centres as it was possible to reach with the machines at my disposal.

"I decided on the latter plan, for the following reasons:

"(i) It was not possible with the forces at my disposal to do

sufficient material damage so as to completely destroy the industrial centres in question.

"(ii) It must be remembered that, even had the Force been still larger, it would not have been practical to carry this out unless the war had lasted for at least another four or five years, owing to the limitations imposed on long-range bombing by the weather."

Value of Day Bombing

Atmospheric and technical difficulties, however, were overcome to a large degree by the excellent and accurate information afforded Trenchard by his Intelligence Department on all targets such as German gas factories, aeroplane engines and poison-gas factories. Each such target had a complete detailed and illustrated plan, and maps were prepared of every target that was within reach; these being supplemented in a large way by the aerial photographs taken by reconnaissance machines. Assuming that "the moral effect of bombing stands undoubtedly to the material effect in a proportion of twenty to one," and while acknowledging that "the preparation of day bombing squadrons in the Force should be slightly larger than that of the night bombing squadrons," General Trenchard considered that, if day bombing was excluded, at least four-fifths of the value of night bombing would necessarily be wasted, as the enemy could then make his arrangements to work by day and live at a distance by night. While, before it was possible to attack Germany successfully through the air, it was necessary to attack the enemy's aerodromes heavily in order to prevent his attacking our aerodromes by night.

German Railways the First Objective

"I also had to decide," Trenchard reported, "when it was impossible for squadrons to reach their objectives well in the interior of Germany, what alternative objective should be attacked, and which attacks would have the greatest effect in hastening the end of hostilities. I decided that railways were first in order of importance, and next in importance the blast furnaces.

"The reason of my decision was that the Germans were

extremely short of rolling stock, and also some of the main railways feeding the Germany Army in the West passed close to our front, and it was hoped that these communications could be seriously interfered with, and the rolling stock and trains carrying reinforcements or reliefs of munitions destroyed. They were also fairly easy to find at night.

"I chose blast furnaces for the second alternative targets as they were also easy to find at night, although it was difficult to do any really serious damage to them owing to the smallness of the vital part of the work."

I.F. Reinforcements

The 8th Brigade, R.A.F., was now gradually reinforced by the following squadrons:

No. 104 Squadron, De Hav. 9, B.H.P., May 23.
No. 97 Squadron, Handley-Page, Rolls-Royce, August 9.
No. 215 Squadron, Handley-Page, Rolls-Royce, August 19.
No 115 Squadron, Handley-Page, Rolls-Royce, August 31.
No. 110 Squadron, De Hav. 10, Liberty, August 31.
No. 45 Squadron, Sopwith Camel, September 22.

However, the new squadrons could not be used for work over the line until three weeks after their arrival, as during this period they were receiving their final training, which could only be carried out at the front.

No. 45 Squadron was intended to attack the enemy's scouts many miles over the line. It was necessary to re-equip this squadron with longer-range scouts after its arrival, but as these machines did not arrive before the Armistice was signed the squadron was only used for attacking individual hostile machines which crossed our lines.

During August No. 100 Squadron, which was armed with F.E. 2b short-distance machines, commenced re-equipping with Handley-Pages. While it was being re-equipped—which process took nearly the whole month—scarcely any work could be carried out.

Adverse Conditions

The weather during June, July and August was extremely favourable for long-distance bombing, but during September,

October and the first ten days of November it could hardly have been worse for this particular work. Day after day attempts were made to reach the long-distance targets, but the wind was generally too strong; or, if there was no wind, heavy rain and fog prevailed by day and dense mist by night, which lasted often until ten or eleven o'clock the next morning. Often the nights were perfect, but dense white mist completely obliterated the ground, making it impossible for machines to ascend.

By the end of June the enemy was increasing the number of fighting machines opposed to us. These new enemy machines were presumably being provided from squadrons he had withdrawn from the Russian Front, and re-equipped for Home Defence work. In September and October our day bombing squadrons had to fight practically from the front line to their objective, and from there home again. In several cases they had to fight the whole way out and the whole way back. This necessitated the most careful keeping of formation in order to avoid undue casualties, as once the formation was split up the enemy's machines could attack individual machines at their leisure. When our machines were in formation he generally concentrated on the rear machines, occasionally making attacks on the machine in front.

Triumph over Difficulties

Despite these unfavourable conditions much valuable work was carried out.

In June the longest distance flown out and back by day was 272 miles, and by night 240 miles.

In July the longest distance flown out and back by day was 272 miles, and by night 300 miles.

In August the longest distance flown out and back by day was 330 miles, and by night 342 miles.

In September the longest distance flown out and back by day was 320 miles, and by night 320 miles.

In October the longest distance flown out and back by day was 320 miles, and by night 272 miles.

A large amount of photographic reconnaissance was done by individual machines at a great height. This work was

nearly always successfully carried out, and only one photographic machine was lost during the whole period of operations.

Photographs proved time and again the efficiency of the work of the bombing machines. Captured correspondence testified to the great moral effect of the bombing attacks on Germany.

August Records

August, perhaps, was the most successful month in the brief history of the Independent Force. During that month this I.F. made successful raids upon no fewer than twenty-one important towns in Germany, in addition to a large number of raids upon such German aircraft stations as Buhl, Boulay, Freisdorf, Morhange, etc., and other military objectives.

The following is a list of the large industrial centres attacked (exclusive of aerodromes, etc.), showing the precise military objectives upon which the bombs were discharged, and the number of times each place was raided:

Towns	*Objectives*	*Times raided*
Bettembourg	Railway station	1
Burbach	Factories	1
Coblentz	Railways	1
Cologne	Railway and factories	1
Darmstadt	Railways	1
Dillingen	Factories	1
Duren	Factories	1
Ehrange	Railway junction	1
Frankfort	Factories and railways	3
Karlsruhe	Station	1
Luxembourg	Railway station	1
Mannheim	Chemical factory	3
Metz-Sablon	Railways	3
Offenburg	Station and railways	1
Remilly	Railway junction	1
Rombach	Factories	1
Saaralbe	Chemical factory	1
Saarburg	Railways	3
Thionville	Railway workshops	3
Treves	Railways and workshops	3
Volkingen	Blast-furnaces	1

Three Months' Activities

During the three months June, July and August the R.A.F. Independent Force made 249 aerial raids over German territory, dropping 247 tons of bombs upon enemy railway centres, munition works, poison-gas factories, electrical and engineering plants, blast-furnaces, aerodromes and other important military objectives.

The German territory thus brought definitely into the war zone by British airmen represented a belt of the Rhine valley roughly 250 miles long, from Cologne in the north to the Grand Duchy of Baden in the south, a region crowded with war industries, and intersected by a railway system of vital strategic importance to the German army in France.

This latter fact explained the high proportion of the British raids which had been specially directed against the key railway centres in the Rhine Provinces, notably those at Thionville and Metz-Sablon. During the period June-August, 1918, the famous railway triangle at Metz-Sablon and the junction at Thionville were raided no fewer than forty-six times. Many photographs taken during these raids confirmed the extent and magnitude of the damage caused.

Metz-Sablon and Thionville

Thus, at Metz-Sablon during a single raid, an engine shed known to contain twenty-five engines was hit, two trains on the southernmost track on the south arm of the triangle were burned out, and several other tracks in the same arm were seriously damaged. Although slight damage to permanent way could usually be patched up in a few hours, there was photographic evidence to show that the repeated raids of British airmen upon this important railway junction had, at frequent intervals, very materially reduced its war traffic, which had apparently often been held up for many hours at a time when quick and regular transport of munitions was most vital to Germany's military needs.

At Thionville bombs dropped by British airmen on July 16 started a big fire, which, fanned by a strong south-westerly wind, developed into a huge conflagration that was only arrested on the river bank. Photographs taken the following

day clearly showed the charred remains of several trains on the track, while the goods station itself and some important riverside buildings were completely burned out.

The big industrial centres on the Rhine contained, in addition to important railway junctions, some of the largest munition, poison-gas and electrical undertakings in Western Germany. These legitimate military objectives were repeatedly attacked by British airmen with very marked effect. Thus the factories at Mannheim, including the notorious Badische poison-gas works, were heavily bombed no fewer than eleven times; the works and railway station at Saarbrücken eight times; the factories, station and barracks at Coblentz five times; Karlsruhe five times; Frankfort-on-the-Rhine three times; Stuttgart twice; Zweibrücken twice; Cologne twice; etc.

Mannheim

The material results of these raids were very considerable. At Mannheim, in the course of three consecutive night-raids, extensive damage (confirmed by photographs) was caused to the Badische poison-gas works, including the partial destruction of the sulphuric acid and nitric vitriol factory, and the aniline department, while much damage was also caused to two large buildings north of the laboratory. At Cologne, Coblentz and Mannheim a heavy death roll attended the attacks of British airmen upon military objectives at those places.

An immediate effect of the raids was the compulsory withdrawal by the Germans of a large number of squadrons from the fighting fronts for the defence of the Rhine. Whilst these concentrations did not prevent a single British squadron from reaching its chosen objectives, the haunts of these enemy forces were not neglected by the R.A.F. Independent Force. Thus, in the period June-August, inclusive, Boulay aerodrome was heavily bombed no fewer than 32 times; Morhange 14 times; Buhl 13 times; Freisdorf 8 times; Hagenan 5 times; etc.

Heavy German Losses

These attacks, often made from a very low height, resulted

in heavy losses for the enemy, a large number of hangars being burned out, and many valuable machines destroyed.

The profound and widespread moral effect of this persistent British air offensive over Germany is seen in the fact that at dozens of public meetings in the Rhine towns about this time excited citizens passed resolutions protesting against the raids, calling for their mutual limitations, or, in default of this, for drastic and often quite impracticable measures of defence; that captured letters from places as widely separated as Mannheim and Cologne all testified to the terror and panic inspired by the raids among the civil population; while well-to-do families in increasing numbers were seeking the temporary security of more distant inland towns.

Another Record Month

In September the Independent Force once again broke all its own records by dropping over 178 tons of bombs upon military objectives in Germany.

The rapidly growing severity of these raids is strikingly indicated by the following figures, showing the total weight of bombs dropped over Germany during these four months:

June, 1918	66 tons
July, 1918	81 ,,
August, 1918	100 ,,
September, 1918	178¾ ,,

A large number of the September raids were carried out in conjunction with the brilliantly successful Franco-American attack upon the St. Mihiel Salient, when, for three days and nights, a practically continuous assault from the air was made upon the railway junction and triangle at Metz-Sablon and other German centres vital to the supply of this part of the Western Front.

September Raids

The following is a list of the more important places in Germany attacked (exclusive of aerodromes, etc.), showing the precise military objectives upon which the bombs were

discharged, and the number of times each place had been raided:

Towns	*Objectives*	*Times raided*
Metz-Sablon ..	Railway junction and triangle	24
Mannheim ..	Chemical factories	6
Karlsruhe ..	Factories, docks, and station ..	4
Ehrange	Railways..	4
Kaiserslautern ..	Factories..	3
Saarbrücken ..	Railways..	2
Thionville ..	Railways..	2
Frankfort ..	Factories and railways ..	2
Burbach	Blast-furnaces	2
Hagondange ..	Blast-furnaces	1
Mainz	Railway junctions	1
Rombach ..	Blast-furnaces	1
Stuttgart ..	Factories	1
Treves	Station	1

In addition to the above a large number of very effective raids were made during September upon the German aerodromes at Buhl, Boulay, Frescaty, Morhange, etc.

An Historic Phase of the War

Finally, something more than a passing interest attaches to the official figures relating to the bombing of Germany during the last thirteen months of the war. During this period R.A.F. squadrons made the astonishing number of 709 bombing raids over German territory as follows:

Raids upon large German towns	374
Raids upon German aerodromes established for the defence of the Rhine	209
Raids upon other military objectives in Alsace-Lorraine and Germany	126
	709

It will be noted that more than half of the total number of raids were upon important German towns, many of them situated more than 100 miles from the base of the R.A.F. Independent Force at Nancy. Indeed, the average distance covered by each squadron (out and home) varied from 120 to

160 miles per raid, whilst it was no uncommon thing for the weekly average to rise to the figure of close upon 200 miles per raid during periods favourable to long-distance bombing.

The following table gives exact details of the raids made upon important German towns, showing the military objectives attacked in each case:

Towns	*Military Objectives*	*Times attacked*
Metz-Sablon ..	Railway triangle and junction	91
Thionville ..	Factories, station, railways ..	52
Mannheim ..	Chemical and aeroplane factories, station, docks ..	29
Burbach	Factories..	17
Saarbrücken ..	Factories, station, railways ..	17
Treves	Factories, station, railways, barracks	17
Offenburg ..	Station, railways, barracks ..	12
Karlsruhe ..	Factories, station, railways, docks	12
Kaiserslautern	Factories, station, railways, barracks	10
Karthaus (Konz)	Railways, bridges	9
Coblentz.. ..	Factories, barracks, stations, railways	8
Sarrburg.. ..	Junction, sidings	7
Ehrange	Railway junction	6
Frankfort ..	Factories, station, railways ..	6
Hagondange ..	Factories, railways	6
Dillingen ..	Factories..	5
Metz	Station, railways	5
Kreutzwald ..	Electric power-station	4
Landau	Gas-works, station, railways, barracks	4
Pirmasens ..	Factories, station, railways ..	4
Stuttgart ..	Factories, station	4
Zweibrücken ..	Factories, station, railways, barracks	4
Cologne	Factories, stations, barracks ..	3
Mainz	Factories, railway junctions ..	3
Rombach ..	Blast-furnaces	3
Volkingen ..	Blast-furnaces	3
Wadgassen ..	Blast-furnaces, railway ..	3

Towns	*Military Objectives*	*Times attacked*
Baden	Station, railways	2
Düren	Factories..	2
Lahr	Station, railways	2
Maizieres ..	Factories, railways	2
Oberndorf ..	Powder factory, munition works	2
Bonn	Railways..	1
Darmstadt ..	Railways..	1
Forbach	Factory	1
Freiburg.. ..	Munition factories, barracks ..	1
Hagenau.. ..	Station, barracks	1
Heidelberg ..	Station	1
Herzing	Railways..	1
Leiningen ..	Station	1
Mertzig	Railways..	1
Moulins-les-Metz	Railway triangle	1
Pforzheim ..	Factories, station	1
Rastatt	Station	1
Rottweil.. ..	Powder factory	1
Saaralbe	Chemical factory	1
Sollingen ..	Wharves	1
Speyer	Station	1
Wittlich	Factory	1
Woippy	Railways..	1
Worms	Chemical factories	1
Wurtemberg ..	Station	1

Trenchard's Praise of his Men

Little wonder, then, that, in the light of these remarkable achievements, General Trenchard, their commander, should report of the aviators under his command: "The courage and determination shown by the pilots and observers were magnificent. There were occasions in which a squadron lost the greater part of its machines on a raid, but this in no wise damped the other squadrons' keenness to avenge their comrades, and to attack the same target again and at once.

"It is to this trait in the character of the British pilots that I attribute their success in bombing Germany, as even when a squadron lost the greater part of its machines, the pilots, instead of taking it as a defeat for the Force, at once turned it into a victory by attacking the same targets again

with the utmost determination. They were imbued with the feeling that whatever their casualties were, if they could help to shorten the war by one day, and thus save many casualties to the Army on the ground, they were only doing their duty. I never saw, even when our losses were heaviest, any wavering in their determination to get well into Germany."

* * * * *

So ends the history of the Great War in the Air, which surely is without a parallel or an equal in the annals of human history, in the heroism displayed, in the marvellous results achieved, no less than in the daring and abandon of the youth who comprised the greater part of the service—deeds bordering on the unbelievable, eclipsing the wildest imaginings of the romances of Jules Verne, or the scientific prognostications of H. G. Wells.

In these five crowded years of travail and agony, centuries of scientific development and progress in the problem of human flight were bridged, whole epochs of military science were engulfed in the evolution of air machines as engines of human destruction in the barbarous art of warfare. The tales told day by day in the brief lines of the official reports—when they were told—contain but the bare bald statements of certain facts of military significance; behind the statements, which later information has here and there been permitted to amplify, there is seen only a small something—indeed a very small something—of the imperishable greatness, of the sublime achievements of these golden youths, which beggars all human thought or speech to give it suitable or adequate form of expression.

During these years the blue canopy of Britain hummed with the droning of engines overhead; the marvel of human flight became a commonplace; day and night saw the sky dotted with airmen performing evolutions that made one hold one's breath—fit preparation for the stern and desperate task to which they were soon to be called overseas.

The classic tales of ancient Greece and Rome, the epics that have inspired the bard and poet, and which have been penned and sung from time immemorial, pale into insignificance

before the amazing deeds which we have with all too halting pen tried to envisage and, as it seems to the chronicler, who has essayed the task of weaving the scattered threads into some sort of picture—of giving some form and coherence to the tale before time has effaced its outlines or dimmed the lustre and glory of its colours, before the short-lived memory of man or the innate modesty of those heroes who are still with us, has obscured their magnificence. To those who fought and fell, their deeds of unparalleled daring and heroism will remain with us, a national heritage.

The historian has but to record events of the past; he may not venture upon speculations as to the future; but this he may do before he lays down his pen: so long as British youth, British courage and British chivalry maintain the unassailable traditions so gloriously evidenced by her airmen in the long, long struggle against a barbarous and unspeakably savage foe, so long will she maintain that essentially spiritual quality, the supremacy of the air, which ultimately proved so great a factor in the final destruction of the enemy.

We close with the words of the Premier, spoken in the House of Commons after the conclusion of hostilities, with reference to the glorious deeds of the Air Service in the war:

> *"Every flight was a romance, every record an epic. They are the Knighthood of this war, without fear, without reproach.*
>
> *"They recall the old legends of chivalry, not merely by daring individuality, but by the lofty nobility of their spirit, and among the multitude of our heroes let us think of the chivalry of the air."*

Printed by
Cassell & Company, Limited, La Belle Sauvage,
London, E.C.4